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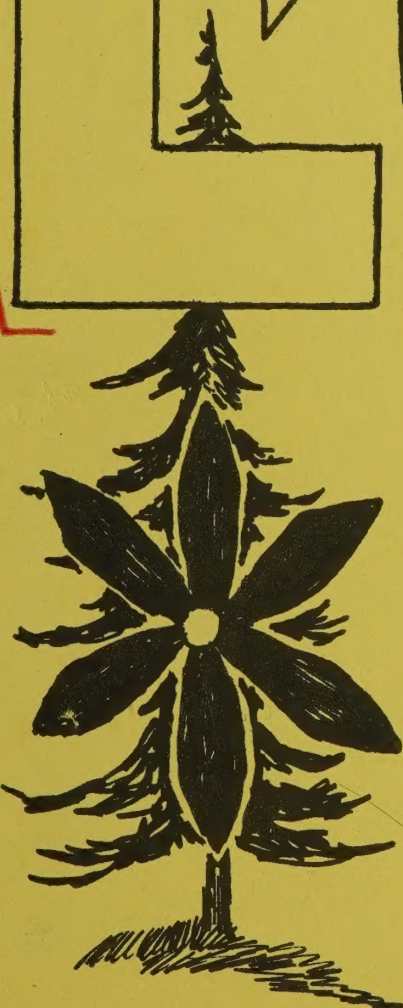
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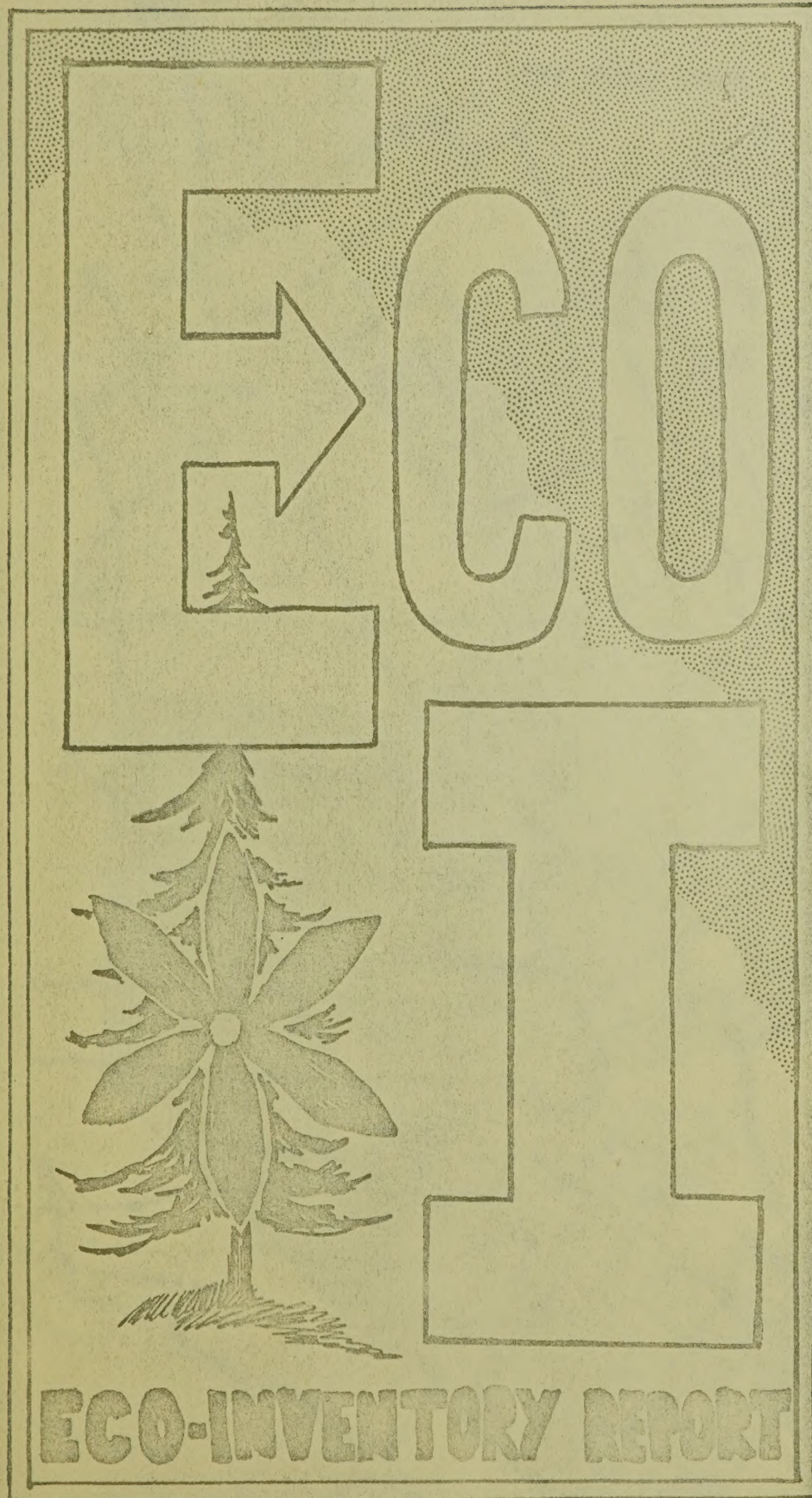
AN
ENVIRONMENTAL
APPRAISAL
OF
HALTON AND
WENTWORTH
COUNTIES

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ECO-INVENTORY REPORT

Compiled Fall, 1971
Printed Summer, 1972



the eco-inventory is a study undertaken by twenty-one students during the summer of 1971.

it was sponsored by the hamilton federation of environmental groups and funded jointly by opportunities for youth and the canadian association of the human environment.

the report presents an environmental appraisal of the region surrounding hamilton, including halton and wentworth counties and the municipalities therein.

it is an integrated and interrelated collection of information on local factors of environmental concern.

with major findings and conclusions on such things as urban parks, air and water quality, natural areas, and the niagara escarpment, this 560 page report is felt to be an unprecedented and factual environmental inventory of the hamilton-centred area.

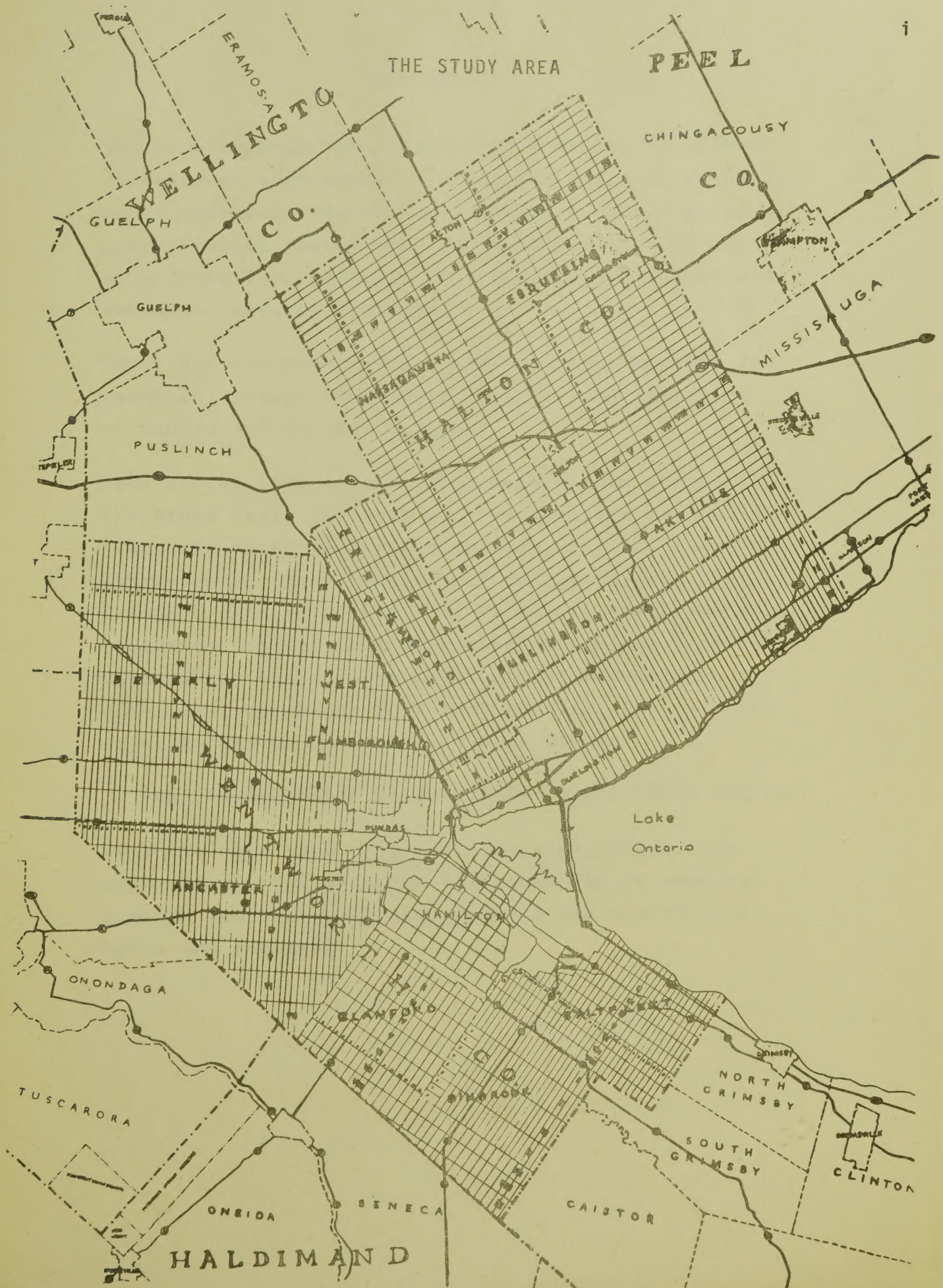
it is hoped that this report will become a tool for all future land use planning in the studied area, a valuable reference document for libraries, a guideline for other urban-centred areas wishing to carry out similar studies and a source of useful information for environmental groups.

To Order, Contact:

Eco-Inventory,
c/o 157 Catharine South,
Hamilton, Ontario,
522-9395.

Wed., Sept. 6, 8:00 pm.
City Hall Council Chamber

THE STUDY AREA



DEDICATION

The Eco-Inventory is premised on a desire to afford our natural environment the respect and care to which it is entitled. We will all be the poorer - physically, aesthetically, materially and spiritually - if we, as a community, continue to violate natural laws and desecrate natural resources.

There are countless people who have been working for years in various capacities towards a reallocation of public and private values.

Some act as individuals; some work within groups like the Bruce Trail Association, the Hamilton Naturalists' Club, the Conservation Authorities, the Architectural Conservancy, Clear Hamilton of Pollution, Zero Population Growth, PRESERVE, the Citizens' Committee for Pollution Control, the Consumers' Association of Canada, the City of Hamilton Pollution Control Committee, the Mount Hope Horticultural Society, the Royal Botanical Gardens, and many others.

THE ECO-INVENTORY IS DEDICATED TO ALL THESE PEOPLE

with the hope that, through concerted action, the aspirations that we share with them may be attained through whatever political, social and educational means are available.

THE HAMILTON FEDERATION OF ENVIRONMENTAL GROUPS

The proposal for the Eco-Inventory was drawn up by members of the executive of the Hamilton Federation of Environmental Groups. The Federation brings together organizations in the Hamilton metropolitan area which are in some way concerned with the deterioration of our environment and are working to improve the conditions of our physical and social environments.

The organizations participating in the Federation are:

- CHOP (Clear Hamilton of Pollution)
- ZPG (Zero Population Growth)
- CCPC (Citizens' Committee for Pollution Control,
Burlington)
- CAC (Consumer's Association of Canada)
- GROUP
- PRESERVE (Ancaster)
- AIRPORT (Citizens' Committee on Mount Hope
Airport Expansion)
- Rolston Manor Ratepayers' Association
- City of Hamilton Pollution Control Committee
- Iroquois Branch, Bruce Trail Association
- Hamilton Naturalists' Club

The number of citizens directly represented by membership in the Federation's constituent groups is approximately 4,500. Ultimately, through the participation of organizations such as the Pollution Control Committee of the City of Hamilton, the entire population of the region is represented.

THE HANITON FRANCHISE IN CONSTITUTIONAL HISTORY

The franchise for the Haniton district was first given in 1854, and was then limited to the owners of freehold property. In 1861 it was extended to include leaseholders, and in 1868 it was further extended to include tenants of houses. The franchise was then given to all ratepayers in 1872, and in 1884 it was given to all householders. The franchise was then given to all ratepayers in 1884, and in 1884 it was given to all householders.

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- To Bill Powell, who designed the report cover;
- and finally
- To all the people - students and the Management Committee, many of whom worked late into the wee hours and on weekends - who helped to make this the hardest-working, most thoroughly enjoyable and interesting summer ever.

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FORWARD

One of the most fascinating things about the study of ecology is finding out that everything fits together into an organic network, all parts affecting all other parts in some way. The implications of this are foreboding when we realize that altering one input can drastically change something else that, on the surface, does not seem to be related.

For example, if a woodlot is cut down, certain species of plants and animals will disappear because they cannot live outside this ecosystem. Major soil erosion may occur when protective tree cover is removed, which means heavy rains result in run off and flooding, instead of contributing to the ground water supply. The courses of rivers and creeks may change and possibly underground sources of water for wells and reservoirs may dry up or become polluted or inaccessible.

History has shown that misuse of the natural environment either destroys the ability of an area to sustain human habitation, or severely diminishes the quality or richness of human life. To sustain human habitation and urban development, we are forced to acknowledge that the wheel has turned full circle. At some point in the constant interaction of the organic (the natural world and its immutable laws) and the technological (man's re-creation of the world with all the accompanying and sustaining social institutions), the organic reasserts itself. Man, despite his technological "advancement", is unable to control the natural ecological chain of events.*

* I am indebted to Dr. Ross Hall for the stimulus of some of his ideas concerning the interaction of the organic and the technological.

"Progress" has robbed the Caribou Eskimo of their traditional environment and source of food and life. At the same time, it has destroyed their social makeup, and, eventually, their psychological source of strength and uniqueness. Are we, the urban dwellers, to find ourselves in a similar predicament?

Of what use are the housing, jobs and high wages to be found in the cities of Southern Ontario if we must pay the price of psychological pressure and psychosomatic symptoms of the tension that we feel? What if the conservation areas, or even city parks, are so crowded that we cannot use the natural world as a source of regeneration and re-creation?

Are unique entities, like our lake and escarpment, so inherently worthless that we are willing to deny completely their ecological, cultural, historic and recreational values in order to build houses, industries and highways that are identical to houses, industries and highways in Toronto, Pittsburgh, Los Angeles, London or Tokyo?

Do we realize that in Ontario, during the last year, for every five of our tax dollars that paid for the construction of a highway, *13 cents* were allocated to support programs of Conservation Authorities.

All of these questions point up the *necessity* for all of us, as citizens and members of a community, to reassess our priorities and translate them into implementation. The burden of this lies heavily on the shoulders of community leaders and community planners who are charged with responsibility for the well-being of citizens.

We cannot plan to provide housing without evaluating what it is that we must destroy in order to build. We cannot plan to expand water-front industry without assessing the effect of this on the toxicity of the water we drink and the air we breathe. We cannot build highways or airports on top of highly productive farm land without first taking a very careful look around for other sources of food supplies.

And since money is our society's most widely used yardstick, we must be realistic and honest enough to foresee that destruction of our natural environment will at some point, not too far in the future, burden us with escalating economic pressures. If this is the only argument that is widely acceptable, then let the economic argument be used. But let us not deny other values such as beauty, the value and diversity of living species, the uniqueness of the heritage afforded by our physical environment and peace of mind. We have hoped, with the compilation of this report, that those who make decisions and those who have to live with them will be introduced to or supported in their belief that man must live in harmony with his environment, rather than in opposition to it.

We are hoping that, despite limited time, we have brought together a wide range of important information in a coherent and inter-related form, to form a basis for *all* - politicians, planners, civil servants and citizens alike - to take a good, hard and well-informed look at what we *want* our community and environment to be.

The first part of the book is devoted to a general survey of the history of the English language, from its origin in the prehistoric period to the present day. It is a history of the language as it has been spoken by the English people, and not as it has been written by the English writers. The second part of the book is devoted to a study of the English language as it is spoken by the English people in the present day. It is a study of the language as it is spoken by the English people in the present day, and not as it has been written by the English writers.

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SUMMARY AND OVERVIEW

The Eco-Inventory is an environmental* study sponsored by the Hamilton Federation of Environmental Groups and funded jointly by Opportunities for Youth and the Canadian Association on the Human Environment. It was conceived on the premise that land use planning and policies cannot be properly stated without, at first, having a complete inventory of an area's resources.

The Eco-Inventory presents an environmental appraisal of the region surrounding Hamilton, including Halton and Wentworth Counties and the municipalities therein. The purpose of this study was to collect and collate inter-relate and document the information already available on local factors of environmental concern given the time limitations. Included is an inventory of natural resources in the rural and urban parts of the study area and an inventory of local agencies; the public, semi-public and private bodies that exercise decision-making powers that shape the environment in some way.

The ultimate goal of the Eco-Inventory is to make available to decision-makers, public servants and citizens an easily-accessible compendium of environmental information. This is done with the hope that the report will stimulate:

- i) planning and decision-making for future land use and resource development that includes an environmental component as strong as the economic factors are presently;

* 'Environmental' is defined broadly; while it obviously embraces the *natural* environment and ecological factors, it also includes the *social* environment, especially in the areas of recreational, historical and urban resources and unique natural features of the region surrounding Hamilton such as the Niagara Escarpment.

2. Public access to Hamilton Bay is well below satisfactory levels. The only sites available are the Harbour Commission's Building (which is not a park), LaSalle Park with 2,250 feet of water frontage and Edgewater Park with an area of 0.12 acres and 250 feet of water frontage. Both LaSalle and Edgewater Parks are in Burlington and in terms of accessibility are far away from the majority of Hamilton residents. Sites with potential for public access to the Bay are extremely limited.
3. Public access in Burlington to Lake Ontario is limited to Spencer Park (13 acres) and Sioux Lookout (0.70 acres) which together provide 2,600 feet of waterfront over a shoreline of several miles. Only seven sites remain in Burlington which could be acquired for public access to Lake Ontario. Even if all seven are acquired, together they would only provide an additional 2,400 feet of shoreline.¹

Transportation

Two freeways, the Mountain Freeway and the Redhill Expressway, are planned for the City of Hamilton.

Preservation of The Escarpment

1. In 1968 the Gertler Report recommended that in regions under the jurisdiction of the Niagara Peninsula Conservation Authority, the Hamilton Region Conservation Authority and the Halton Region Conservation Authority, 8,980 acres of Escarpment land be acquired outright and 13,300 acres be controlled through easements. The bulk of the land

¹ It appears that two of the seven sites are now slated for development. One will be used for a twin-tower complex and the other for row housing.

in these three areas was given a priority rating of one, which means that it should be acquired or controlled by 1972. As of March 1971, 3,226 acres (36 percent) had been acquired outright and none had been acquired through easements. Of the 3,226 acres acquired up until March 1971, only 979 acres (11 percent) were acquired after the Gertler Report was released in 1968.

2. Since 1968 (when the Gertler Report was released) to March 1971, the government of Ontario has spent \$3.4 million on Escarpment land. During the 1970-71 period, \$750,000 was spent.

Quarrying on the Escarpment

1. Of the 45 extractive operations in our study area, 36 are operating on the Escarpment.
2. One estimate projects that by 1980 about 23 million tons of crushed stone will be produced from the Escarpment between Waterdown and Acton. This is equivalent to a strip of land 1/2 mile by 1/3 mile by 60 feet deep annually.

Conservation Authorities

1. The Niagara Peninsula Conservation Authority appears to be inactive. Since 1968 when the Gertler Report was released it has acquired 3 acres of Escarpment land. It has not implemented flood plain control in its area. It has by far the lowest financial base of the Conservation Authorities in the study area but has no plans to improve it. This is especially critical since all the land to the immediate south of Hamilton is under the N.P.C.A. jurisdiction

and this could greatly affect the number and quality of recreational sites available to people living in the Hamilton metropolitan area.

2. The other Conservation Authorities in the watersheds surrounding the Hamilton metropolitan area - the Halton, Hamilton, Grand River and Long Point Authorities, considering their very small budgets, have made commendable progress in programs both for land acquisition and protection of river valley corridors.

Unique Natural Areas

1. Many unique habitats with rich variety and species diversity exist within easy driving distance of the Hamilton metropolitan region. Unless protected through the establishment of nature reserves or authority acquisition, many of these areas with their representative plant and animal communities will be lost through drainage or development.

Recommendation

From an environmental viewpoint, the Hamilton area and its environs is in bleak condition. All major bodies of water and streams are polluted. Air pollution is probably the worst in Canada. There is a large deficit of urban parks. Access to the Bay and Lake Ontario is extremely limited in relation to the population. The total public land holdings on the Escarpment are small compared to the stated objectives of the provincial government while efforts to acquire more land are inadequate. Many diverse plant and animal communities are still intact but they are quickly disappearing.

To complement this, the population of the area is expected to double in about 30 years. Industrial expansion may more than double, perhaps even tripling before the turn of the century. It seems apparent that decisions have been made (or are close to being made) to proceed with the construction of several major highways and expressways of 4 lanes or more. It appears likely that a much expanded airport may soon be operating at Mount Hope. In short what is now "on the ground" will likely be more than doubled by the year 2000.

In view of the present environmental condition of Hamilton and its outlying areas - and the most likely developmental trends in the future - we make one recommendation, that a local Environmental Advisory Council be established:

1. to set priorities and objectives regarding the environmental problems now affecting Hamilton and outlying areas, and
2. to evaluate and determine the environmental impact of future developments.

It is envisaged that such a local Advisory Council would have the authority to demand environmental impact studies before developmental projects are allowed to begin, would be able to demand that alternatives to specific developmental projects be evaluated and would be able to order public hearings.

CHAPTER ONE

TWO

PART ONE

AIR AND WATER QUALITY

by Hignley

THE
AIR AND WATER QUALITY

CONTENTS

CHAPTER ONE
THE BAY

bev biggley

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INTRODUCTION

The Bay over the last 60-100 years has deteriorated from a recreational area of bathing, shooting, fish and rowing activities into an industrial and sanitary wastebasket. Prior to 1963, Hamilton processed its sewage through an "iron grating" before it entered the Bay. The result of neglect has been a gradual deterioration in the quality of the Bay environment. It is the purpose of this report to try to suggest the reasons for this destruction.

Morphometry of Bay

Geologically, the Bay is fairly young, emerging as the last glacial ice retreated north 20,000 years ago leaving behind an evolving chemical, physical and biological balance between flora and fauna. Unfortunately this delicate balance of nature has been disrupted by man's development in the past 60 years, and our plans for the future will determine whether this disruption is to be irreversibly complete.

Hamilton Harbour lies at the extreme western end of Lake Ontario separated from the lake by a natural sandbar. As a natural settling basin it receives drainage from 179 sq. miles of watershed plus the wastewater from the City of Hamilton. The wastewater flow makes up about 50% of the total contribution of water to the bay¹ but comprises only 16% of the watershed area. In 1949 the sewage flow accounted for 26% of the flow through the Bay; in 1957 this had increased to 35%.

¹ Johnson, M.G., Matheson, D.H., *Macroinvertebrate Communities of the Sediments of Hamilton Bay and Adjacent Lake Ontario* 1968

Translated into acres and gallons of water, the bay area of 11.3 sq. miles represents 7200 acres and 68 million Imperial gallons (68,000 million gallons) of water. Twenty-five percent of the area is less than 6 feet deep (mainly in the south and south-west) and only 15% of the area is more than 60 feet in depth. The maximum depth is 82 feet.²

Historical Development

Tracing the historical milestones in the development of the Bay gives some measure of the "price of progress". The Bay area has always been known by many names. Today it is called either The Bay or Hamilton Harbour depending on which side of the controversial fence you sit. Even as early as 1792 it had two names being referred to simultaneously as Lake Geneva or Macassa Lake. In 1798 it was officially named Burlington Bay only to be changed in 1919 to Hamilton Harbour. Since then (1958) it has been called "Ontario's largest septic tank",³ (1962) "a highly efficient sewage treatment plant"⁴ and (1969) a "Sewer".⁵

The road for the Bay's future development as a port was laid in 1832 when the government of Upper Canada appropriated money to construct the Burlington Ship Canal. In 1846 all properties on Burlington Bay were deeded to the City of Hamilton.⁶ This was the start of an important issue which concerns the present dispute between the Harbour Commissioners and City planners over jurisdictional rights. Resolution of the dispute will determine who will control future development of Hamilton's waterfront.

² *Consolidated report on Burlington Bay*, City of Hamilton Municipal Laboratories, 1958.

³ *Hamilton Spectator*, May 16, 1958.

⁴ *Globe and Mail*, April 19, 1962.

⁵ *Hamilton Spectator*, May 24, 1969.

⁶ Bay Act of Parliament, being Chapter 73, 9 Victoria, 1846.

The Hamilton Harbour Commission was formed by an Act of Parliament in 1912 to take over the administration of the Harbour from City Council which granted the Harbour Commission the power to regulate and control the use and development of all land and property on the waterfront within the limits of Hamilton Harbour. The Harbour was then defined as including all the water of Burlington Bay and Cootes Paradise together with all waterfront property, waterlots, docks, shores and beaches in and along the Bay and water.

In 1947, title to all the land under the waters of the Bay in front of the City was acknowledged to be in the Municipal Corporation of the City of Hamilton, which was then sold for the sum of \$1.00 in 1948 to the Hamilton Harbour Commissioners "to remove any doubt as to the title of water lots or lands under the Hamilton Bay."⁷

A current issue involves City officials who are concerned about planning and zoning regulations for water lots and waterfront areas, especially in the proposed Beach Plan and North End Redevelopment Area, and Harbour Commissioners who feel that planning and zoning for waterfront areas would compromise their jurisdictional rights. Control over waterfront areas is disputed since there is no apparent legal definition of "waterfront". The problem of landfill of waterlots has also caused the Harbour Commission to receive a great deal of ecological criticism. Various concerned groups argue that as landfill operations are continued, the resulting decrease in surface area and volume of water in the Bay will result in serious impairment of the already heavily burdened Bay in its ability to purify itself. Mr. Furry of the Harbour Commission explains that the majority of the landfill operations (totalling, up to 1968, 1408.8

⁷ Indenture, April 1, 1948.

acres or roughly 16 percent of the original Bay area) were in accordance with Letters of Patent already granted by the Dominion or the Province of Ontario prior to 1912, but that none of these waterlots was allowed to exceed the Harbour Headline.

The dispute appears to be one of magnitude. The actual quantity of water that is displaced by landfill operations, especially those located in the south and south-east parts of the Bay, is small in relation to the total quantity of water remaining, but due to the shallow nature of the Bay in these areas, large areas of land are being formed by filling waterlots. Landfill operations can considerably reduce the surface area of the Bay, while reducing the actual volume of water very little.

In 1863, during winter, the Bay froze to a depth of 22 inches from early January to mid March.⁸ By 1949, it was as late as February 3 before the Bay froze to a depth of two inches. This may indicate that a gradual physical change has been wrought in the Bay, possibly due to thermal pollution. In 1970, the steel plants in Hamilton poured enough heat into the harbour waters *every hour* to heat the average Hamilton home for ten years. When surveyed in 1968, the Hamilton steel plants were discharging 1.13 billion British Thermal Units (BTU) of heat per year into the Bay.⁹

Recreational activities have also been altered. In 1876, railroad and steamers brought summer visitors to the Beach Strip, and by the late 1890's and early 1900's it was the fashionable resort area of Hamilton. Burlington Bay became the favourite playground of Hamiltonians. In summer,

⁸ Emery, C. and B. Ford, *From Pathway to Skyway: A History of Burlington*.

⁹ *Hamilton Spectator*, April 2, 1970.

fishermen, swimmers and picnickers could be found at Lansdowne Park, Sherman's Inlet or Huckleberry Point. Land's Wharf at Emerald Street was famous for its pike and bass.

Burlington Bay was also once the home for loons, crows, night hawks and canaries, gannets, eagles and plovers. The majority of the plant and animal wildlife today seeks refuge in Cootes Paradise. (Unfortunately, there has been some rumour that this area too is under consideration for development.)

In late December, seventy years ago, there were ice boats and ice fishing, skating and curling activities on the Bay. In 1915, Wabasso Park (Lasalle Park) was opened. The Bay was stocked in 1921 with black bass and pickerel, and in 1922, 10,000 more pickerel were added along with 30,000 speckled trout in nearby streams. In contrast, carp control experiments had to be undertaken in 1951. Carp are bottom feeders of aquatic vegetation, and are blamed for muddying water to make it unfit for spawning of black bass and pickerel.

The 1970's have shown the disastrous result of a break in the ecological chain. For three weeks in June 1971, 150,000 pounds of rotting fish per day had to be removed from the Beach Strip. The fish, alewives, have a short lifespan and every spring as the water warms up they die and wash up on the beach. Lake trout, pike, pickerel and whitefish once fed on the alewives, but since the disappearance of these larger gamefish the alewives have increased. Now the City must haul their bodies to the dump and bury them.

Swimming in the Bay was stopped in 1924 when Dr. Wythe (Alderman and Chairman of the Board of Health) declared

it hazardous to health. Foreshadows of the future were seen as early as 1887 when this ominous warning appeared in the *Spectator* of November 23:

What will it be like in a few years from now if the present insane idea of emptying the sewage of our fast increasing city into it is carried out? It will be a place that man cannot live on its shores nor fish in its waters - a veritable hotbed of disease. Bathing, shooting, fishing will be a thing of the past and even rowing will not be a desirable pastime over a putrid, filthy mess such as it will become.¹⁰

As settlement in Hamilton grew, demand for water increased and wastes from new industrial development were disposed of into water courses. We had to wait until 1963 before we received a primary sewage treatment plant; before this time, sewage emptied into the Bay through an iron grating.

As industry developed, it added its demand for water, land and disposal areas. The advent of large-scale industry to Hamilton was heralded in 1903 by International Harvester who chose Hamilton for the construction site of the largest implement works in the British Empire. It was joined in June 22, 1910 by the Steel Company of Canada. During the First World War, the Hamilton plant was expanded, and the first coke oven battery was built. A coal and ore dock were also added by Stelco to Hamilton's rapidly-expanding waterfront. The first heat of steel from Dominion Foundries was poured in December, 1912. By 1915, Proctor and Gamble had announced the erection of a million dollar plant. Polluted or not, the Bay remained big business. During the decade of the 1950's, the Hamilton Harbour Commission and Hamilton industry spent more than \$30 million expanding handling wharves and freight terminals in preparation for the increased cargo tonnage anticipated with the opening of

¹⁰ *Hamilton Spectator*, November 23, 1887.

the St. Lawrence Seaway in 1959.¹¹

POLLUTION: PHYSICAL, CHEMICAL AND BIOLOGICAL

The pollution of a water body can be measured physically, chemically or biologically but no single parameter gives a complete understanding of pollution. Physical effects of pollution depend primarily upon the outfall location and character of the sewage discharge. Certain industrial wastes contain substances which will produce certain chemical changes in the receiving water. The depletion of dissolved oxygen, which is of considerable concern under some circumstances, is largely dependent on the oxygen demand of the waste and upon the condition of the receiving water. If a body of water has a low dissolved oxygen content, this condition can only become more acute if a high oxygen demanding waste is added. Domestic sewage has relatively few toxic characteristics; however, industrial wastes may contain a variety, including cyanides.

Dissolved Oxygen

Oxygen dissolved in water is required for the life processes of almost all organisms living in the water. Organisms that exist by removing dissolved oxygen from water or breathing gaseous oxygen are classed as "aerobic organisms", while organisms capable of obtaining oxygen by reduction of substances containing oxygen are termed "anaerobic". Oxygen input to water comes from two main sources: either by direct solution from the air, in which the wind factor is important, or as a by-products of photosynthesis by microscopic algae known as phytoplankton. Turbidity, as it affects the photosynthetic rate, also determines oxygen content.

¹¹ Campbell, Marjorie Freeman, *A Mountain and a City: the Story of Hamilton*.

As water becomes colder it will hold greater amounts of dissolved oxygen in solution. At night dissolved oxygen can drop to zero if the water is warm, shallow and contains much organic matter. Dissolved oxygen content has been called the most useful single indicator of the overall condition of a body of water.¹² It determines whether self-purification is likely to proceed satisfactorily. Values consistently below 4 mg. per litre indicate organic overloading.

When organic compounds are added to a body of water, oxygen required for its destruction comes from the oxygen dissolved in the water. The strength of wastes being added to water is usually expressed as BOD - biochemical oxygen demand (The amount of oxygen required to break the wastes down).

All waters that are thermally stratified, such as the Bay, suffer a decline in dissolved oxygen with depth until the lower stratum may be entirely anaerobic. This is not abnormal, but biologically important. Oxygen-free water will dissolve elements from bottom deposits accumulating a stock of nutrients which will become available under conditions of Fall circulation to the whole water body.

Turbidity

Turbidity causes a lack of water clarity. It is one of the outstanding visible characteristics of Bay water, caused by a combination of suspended particles, plankton population and precipitates. Turbidity has a direct effect on the rate at which photosynthesis can take place. In 1923, a study undertaken by Gore, Nasmith and Storrie, "Report on Sewage Disposal", noted that some areas of Bay water

¹² Bernarde, Melvin A., *Our Precarious Habitat* (New York: Norton, 1970)

were clearer than the lake. This condition does not exist today. In summer, turbidity is increased by the presence of algae, and with a stable stratification (no winds) turbidities in the surface stratum are usually higher than in deeper layers.

Nutrient Elements

The Bay is a complex biological system. The supply of available nutrients determines to a great extent the nature and magnitude of the microbiological community, and in this way represents the biological resources of the water. Nitrogen and phosphorus are two of the most essential nutrient elements for plankton growth. With little organic pollution, the supply of nutrients to a body of water will be low, and consequently the plankton population will be restricted.

Water receiving moderate amounts of sewage effluent will also receive an abundance of most of the required nutrients for growth and the plankton population will flourish. Excessive plankton growths will, however, give rise to objectionable consequences. Algal blooms choke shorelines and, when they die, sink to the Bay bottom to decompose, using up oxygen and releasing nutrients.

In Hamilton we enjoy a unique situation: this has been documented in the *Spectator* of December 9, 17 and 19, 1969.

Every day the two large steel plants discharge an estimated 8×10^3 kg. of iron into the Bay in the form of spent pickling liquor,¹³ which is the acid solution used to clean steel. This iron is in the form of ferrous sulphate which reacts chemically with phosphorus to form iron phosphate.¹⁴

¹³ Matheson, D.H. and M.G. Johnson, *Macroinvertebrate Communities of the Sediment of Hamilton Bay and Adjacent Lake Ontario*.

¹⁴ Hamilton *Spectator*, December 9, 1969.

This substance, heavier than water, sinks to the bottom of the Bay; thus not all of the phosphates are available for plankton growth. Thus algal growth is less than what it might be.

Two-thirds of the total daily inputs of nitrogen and phosphorus are from industrial sources, while sewage treatment plant effluent contributes one third.¹⁵ Because of the amount of iron in the harbour water, some have argued against the necessity of chemically treating Hamilton's sewage. Biochemists and ecologists feel that this *laissez-faire* interpretation is misleading. There is no assurance that the sewage and pickling liquor are in exactly the same proportions, to cancel each other's effects. It seems more obvious and logical to curtail both industrial and municipal pollutants.*

Sanitary Conditions of the Bay

It is at the point of sewer outfalls to the Bay that water pollution begins. Domestic and industrial wastes may contain any of a variety of polluting substances which can cause, in the receiving waters, depletion of dissolved oxygen, deposition of solids with resulting decomposition and release of offensive odours, objectionable scum on surfaces and shorelines and the production of toxic conditions for fish and wildlife. In addition, unsanitary conditions in the Bay may create a menace to human health, particularly as it affects the water quality of Lake Ontario and influences the City's water supply, bathing and recreational uses.

¹⁵ Matheson and Johnson, *op. cit.*

* Some progress is being made by the Steel Companies to convert to HCl acid liquors which can be regenerated. (The Editors)

A bacteriological index is used to monitor Lake Ontario daily, and the Bay less frequently. The number of coliform organisms per 100 ml. sample has increased since 1923.

When the first samples were taken along the beach shore, the average was 300 organisms; in 1947, the samples averaged 2,290 per 100 ml. which rose dramatically to 11,500 per 100 ml. in 1958. The severity of this situation limits the uses available for the Bay.

The variability of the contamination, and its rapid fluctuation, dictates that Bay water may never satisfy drinking requirements, even with treatment. Industrial contaminants could render the water unpalatable even after chlorination, and heavy plankton growth would make both filtration and taste control difficult.

As a bathing area, there is a wide range of opinion concerning the safe bacterial limit. The average standard is 1,000 organisms per 100 ml. Besides the high average degree of contamination, the proximity of all suitable bathing areas to the sewage outfall, and the rapidity with which local contamination varies due to wind-induced circulation, create conditions such that the Bay cannot be considered acceptable for bathing purposes.

Ignoring the bacteriological condition of the Bay and avoidance of its use for drinking or bathing purposes will not, however, improve the situation in Lake Ontario. The increase in pollution of the Lake (primarily attributed to the Bay¹⁶) by organic matter and bacteria is reflected in the increasing amounts of chlorine required for sterilization of raw water at the Filtration Plant -- an increase

¹⁶ Matheson, D. H. *A Pollution Study of Western Lake Ontario*, Publication #9, Great Lakes Research Division, Institute of Science and Technology, University of Michigan, 1962.

from five pounds of chlorine per million gallons of water in 1943 to eight pounds in 1958. Outflowing Bay water containing inorganic nitrogen and phosphorus compounds results in an increase of algae growth in the Lake. Increased amounts of ammonia in the water entering the purification plant seasonally affects the chlorination of the water, and in the presence of phenols from industry, special treatment is required to avoid objectionable taste and odour.

Industrial Pollution

Because of Hamilton's highly industrialized nature and the concentration of heavy industry on the south shore of the Bay, industrial contaminants are of considerable importance. The O.W.R.C. recognized the importance of this problem in 1964 when they undertook a survey of Bayfront industries to determine what wastes were being discharged into the Bay.¹⁷ The twelve plants surveyed in detail employed 20,000 people, consumed 282 million gallons of water a day and discharged 275 million gallons of waste water daily.

The report indicated that industrial loadings in terms of BOD and suspended solids were greater than that contributed by the sewage treatment plant; most phenols, nitrogen and phosphate loadings to the Bay could be attributed to industrial waste discharge. The report suggested a need to reduce nutrients, and made several recommendations to industry that:

1. solids be removed by primary settling;
2. phenols be reduced by recovery or treatment to practicable limits;
3. ammonia and other nitrogen forms be eliminated from effluent as completely as possible;

¹⁷O.W.R.C., *Report on Industrial Waste Loading Discharged to Hamilton Harbour by Bayfront Industries*, 1964.

4. toxic constituents, such as sulphides and cyanide, be treated so they are harmless;
5. oil and grease be separated from effluent.

The report concludes that there was a definite need for the provision of additional treatment at the industrial site or at the point of connection to the municipal sewage system.

CONCLUSION

The outstanding *chemical features* of the Bay are:

- decreasing levels of dissolved oxygen
- very low levels of dissolved oxygen in some areas, especially along the industrial shore
- high nitrogen
- low phosphorus
- increasing turbidity

Along the industrial shore, there is not enough oxygen dissolved in the surface stratum to affect the destruction of the organic pollution that is added here.

Increased sewage pollution of Lake Ontario is indicated by increases in bacterial concentrations.

Physically, the Bay is being reduced in surface area, affecting its natural ability to cleanse itself; the reduction in size of the air-water interface decreases the amounts of oxygen and carbon dioxide which are being dissolved in Bay waters.

Large areas of shoreline containing industry, wharves, piers and warehouses have reduced the aesthetic appeal of and public

access to the south shores of the Bay, with a concomitant deterioration of recreational activities both on the Bay and along its eastern shore.

RECOMMENDATIONS

It seems likely that conditions in the Bay will be subject to further environmental deterioration, in view of the uses advocated by the Hamilton Harbour Commission whose goal seeks the continued and increasing use of the harbour for industrial transportation; it is to be hoped that public concern will be further brought to bear in an attempt to reduce industrial and municipal discharge of objectionable pollutants.

Continued monitoring of water quality by the Municipal Laboratories is essential. Their reports, however, should have more power in affecting control of waste discharges.

Stricter control should be exercised over the discharge of industrial wastes, either directly into the Bay or through the municipal sewage system. The recommendations established in the 1964 Ontario Water Resources Commission Report in conjunction with existing municipal by-laws should be strictly enforced by the Ontario Department of the Environment and the City of Hamilton.

It is essential that industry proceed with a definite programme schedule for waste treatment, for a secondary sewage treatment plant alone will not reduce pollution in the Bay. In fact, the secondary treatment plant simply reduces 90 to 95 percent of the organic solids into more plant nutrients.

Thus this effluent will also stimulate algal and bacterial growth in the Bay.

To reduce the nutrient effluent, Hamilton should implement nutrient removal in the secondary plant. This will be required by Ontario law in the future.*

Oily wastes from industrial shipping should be prohibited. A law that only regulates waste disposal from and provides for small pleasure craft, ignoring the problem created by the larger lake freighters and ocean vessels, is useless. Although it is difficult to impose regulations internationally, some local system should be developed whereby holding tanks and pump-out facilities would be available for the use of international vessels. Wastes gathered could be disposed of in the liquid industrial waste disposal site in Mississauga when it's completed.

Pollution of the aesthetic Bay environment has found its champions in the Save Our Bay Committee. The problem of filling waterlots for developmental and industrial purposes serves to reduce the surface area of the Bay, severely limits public access to the waterfront for recreational purposes, and destroys scenic and historic views.

It is interesting to note that some of the above recommendations were made as early as 1958 and have not yet been implemented. When the City of Hamilton Works Committee recommended that an industrial waste detection crew be established to police the Bay for pollution by industrial wastes, thereby enforcing the existing by-law, it was defeated by a 2 - 2 vote before Board of Control by Mayor Victor Copps and Controller Jim Campbell.

* *Hamilton Spectator*, December 17, 1969, from an article by J. Bryan Kingdon.

Regional management has been suggested as an alternative to municipal or federal control over water resources such as the Bay. This would encourage, hopefully, some uniformity in the care with which planning for the development and use of such resources was undertaken. The recent announcement of an integrated planning study of the shoreline of Lake Ontario and the Bay, to be undertaken by the Halton and Hamilton Region Conservation Authorities is to be applauded. One would hope that such a study, conducted under the auspices of two organizations with excellent credentials in the area of environmental concern, would serve to widen the scope of planning on a regional basis, to incorporate in a single plan the various points of view which presently tend to compete for dominance.

APPENDIX

CHEMICAL COMPARISONS

A comparison of the available data over the past twenty years should give some indication of the extent of pollution that has occurred in the Bay. The last consolidated report was published in 1958. Since then only yearly reports have been published with little analysis given stating either the deterioration or improvements that have occurred.

Dissolved Oxygen (percent saturation)

Station	Depth (feet)	1948	1970
West End	0	74	72
	10	70	70
	20	71	62
	40	67	32
North Shore	0	81	99
	10	83	76
	20	85	68
East Industrial Shore	0	86	6
	10	85	52
	20	83	62
Bay Centre	0	83	68
	10	85	77
	20	85	71
	40	25	34

There has been a general decline in dissolved oxygen from 1948-1970 even with the advent of a primary sewage treatment plant. There also has appeared by 1970 four characteristically distinct areas, the industrial shore most markedly deficient in dissolved oxygen. The presence of two thermally stratified layers defined between the 20 and 40 feet depths is also apparent.

Turbidity at Surface

Station	1950	1970
Bay Centre	8.4	11.5
Canal (avg. for year)	7.0	10.7

In 1958 turbidities in the open water ranged from 5-20 while in inlets subject to local pollution and agitation (such as the Ottawa St. Inlet) turbidities reached as high as 130. Turbidity is usually higher along the industrial shore than in the Bay centre and correspondingly lower along the North shore. If the Bay is stirred by winds a uniform turbidity will be established.

Chloride

Chloride undergoes a marked seasonal change due to the use of de-icing on winter streets. Chloride is distributed uniformly throughout the Bay since it is not involved in chemical or biological reactions.

Annual Averages	Bay Centre	North Shore
1936	19.8	20.0
1937	21.4	20.8
1938	22.2	22.2
1939	20.9	20.3
1940	25.1	24.6
1948	25.0	
1956	31.8	
1970	53.0	

The monthly average of all Bay stations ranges from 66 mg./litre in June to 48 mg./litre in September/October. Chloride concentration is slightly higher near the sewage disposal plant, and decreases with distance from this point.

It is also higher along the industrial shore than at the Bay centre or the north shore. For the 1970 figures, there was little difference between it and open Bay figures. The only obvious source of chloride concentration was sewage effluent.

Nitrogen

The nitrogen input to the Bay is in the form of inorganic nitrogen compounds (ammonia, nitrate and nitrite) and organic nitrogen compounds (the variable results of bacterial decomposition of protein organic matter). Nitrogen output is equal to the inorganic nitrogen compounds in the effluent water plus the nitrogen bound as protein in the plankton cells escaping in the outflowing water. It has been estimated for 1958 that two-thirds of the nitrogen input remains in the Bay bottom muds. (There is research work being done at the Canada Centre for Inland Waters to investigate the possible agricultural uses for this bottom mud. It is a three year study and is due to be completed in 1972.)

In the May to September period there is always a decrease in total inorganic nitrogen. When the water is calm for a few days, the phytoplankton growth is in the top stratum and causes a noticeable depletion in the nitrogen content. A fairly light wind is sufficient to restore uniformity in composition. During the summer, a marked reduction in the total inorganic nitrogen content of the Bay occurs as a result of biological activity. The total inorganic nitrogen (taken as the sum of ammonia plus nitrate - nitrogen, since nitrite is present only in negligible concentrations) for 1970 was higher than it was in the past eight years.

The decline of ammonia nitrogen is more rapid than that of total nitrogen. Oxidation of ammonia by nitrifying bacteria proceeds rapidly in warm water. In late spring (1948), 80% of the inorganic nitrogen was in the form of ammonia, while at the end of the summer, only 50% remained unoxidized. In 1970, for ammonia, all stations reported higher levels, with industrial readings as high as 14.0 mg./litre in June, with the normal summer decline less than that in previous years. Organic nitrogen content is high in late spring when the plankton population is at its maximum.

Phosphorus

Of the two important fertilizing elements phosphorus is the more likely to be deficient. Domestic sewage and synthetic detergents are rich sources of phosphorus. Plankton flourish in a medium containing 0.10 to 2.0 p.p.m. phosphorus and exhibit deficiency symptoms when the concentration falls below 0.05 p.p.m. Inorganic phosphorus is at its minimum in summer. Repeated analyses of the samples from the Bay from April to December have never shown more than 0.01 p.p.m. (1958).

Inorganic phosphorus introduced into the Bay by sewage is rapidly consumed by the phytoplankton and quantities released by the mineralization of dead organic matter are immediately reconsumed by the algae. Experiments in 1958 confirmed that maximum plankton growth in the Bay is limited by the available supply of phosphorus. Until 1958, the amount of inorganic phosphorus was practically zero. Phosphorus may exist bound in organic compounds either in living or dead organisms and is available in absence of appreciable amounts of inorganic phosphorus. The yearly average of total phosph-

ate for all stations sampled in 1968 was 0.17 mg. PO_4 /l or .056 mg. P/litre; in 1969 it was 0.20 and in 1970 0.23 mg. PO_4 /litre. The Bay water contains a very large excess of nitrogen in relation to phosphate.

Bacteriological Counts

Medians of Coliform Counts in Bay

YEAR	WEST END	EAST SHORE	INDUSTRIAL BAY CENTRE	NORTHSHORE
1960	700	250,000	2,500	1,200
1961	1,500	60,000	2,300	700
1962	500	20,000	700	1,100
1963	600	4,000	500	300
1964	1,500	11,000	1,200	900
1965	300	1,000	500	260
1966	1,900	2,600	2,000	1,600
1967	920	3,100	650	400
1968	1,800	5,000	900	800
1969	700	7,000	800	600
1970	600	2,800	350	200
Fecal (1970)	40	900	80	40

Industrial Contaminants

The most significant industrial contaminants (due to quantities involved or effect produced) are phenolic substances, iron and cyanides. Phenolic substances are important in water treatment because of their ability to produce taste upon chlorination when they are present to the extent of a few parts per billion (3+ppb). Chloramine treatment has been used instead of chlorine treatment to avoid the development of chlorphenolic tastes. When temperatures are high rapid destruction of phenol by bacteria would be expected. In 1953, of 80 samples only 5 were 3+ppb. Along the Industrial shore in 1956, 6 samples averaged 700+ ppb, the highest ones due to the proximity of the two coke ovens. Twelve samples taken near the canal averaged 6 ppb. indicating the concentration that would be emitted from the

Bay. The source is the by-product recovery plants associated with coke ovens. Loss of phenolic wastes is inevitable in waste streams even with an efficient system. An activated sludge dephenolizing waste treatment plant can eliminate phenols.

Iron finds its way into the Bay from waste pickling liquor. At normal Bay pH and in the presence of dissolved oxygen iron is completely insoluble and wastes which may not be completely neutralized before discharge are soon neutralized on mixing with Bay water. When unneutralized pickling liquor is discharged into the Bay dilution with alkaline water neutralizes the acid and precipitates blue-black ferrous hydroxide which is soon oxidized by the dissolved oxygen to brown ferric hydroxide which settles out. Both hydroxides are slimy and become attached to objects along the shore. Cyanides are discharged in coke oven by-product operations and from electroplating plants. Toxicity of cyanides is such that receiving waters should not exceed .05 ppm.

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REPORT ON INDUSTRIAL WASTE LOADING DISCHARGED TO HAMILTON HARBOUR BY BAYFRONT INDUSTRIES 1964 O.W.R.C.

NET WASTE LOADINGS TO BAY LBS./DAY

Company	5 day BOD	Suspended Solids	Iron Fe	Phenols	Ether Solubles	Free Ammonia NH ₃	Total Nitrogen N	Phosphate PO ₄	Cyanide	Sulphate SO ₄	Fluoride F	Sulphide H ₂ S	Sulphite SO ₃
Stelco	31000	107000	80000	1050	2770		10600	10	3270				
Dofesco	10800	165000	54000	560	3660	7800	6500		1000			4600	
Proctor & Gamble	3800	330			460								
C.I.L.*	592	644	144			1100	940	13000		12300	1220		304
Cyanamid	1600	1000		2		6400	7400						
Firestone	150	550		0.6	13			30					
Stelco-parkdale	1020	53	7170					10		17300			
International Harvester	480	1100	500		75			165					
Stanton pipes	33	86	15	4				0.3					
National Steel Car	5	100	4		14			2					
Can. Veg. Oil	18	160											
Domtar	28	23		3									
Total	54300	288000	141000	1610	6990	15300	25400	13200					
City Sewage Treatment Plant	39600	43500		17		5340	9900	7700					

CHAPTER TWO

SURFACE WATER

helen eatock (grimes)

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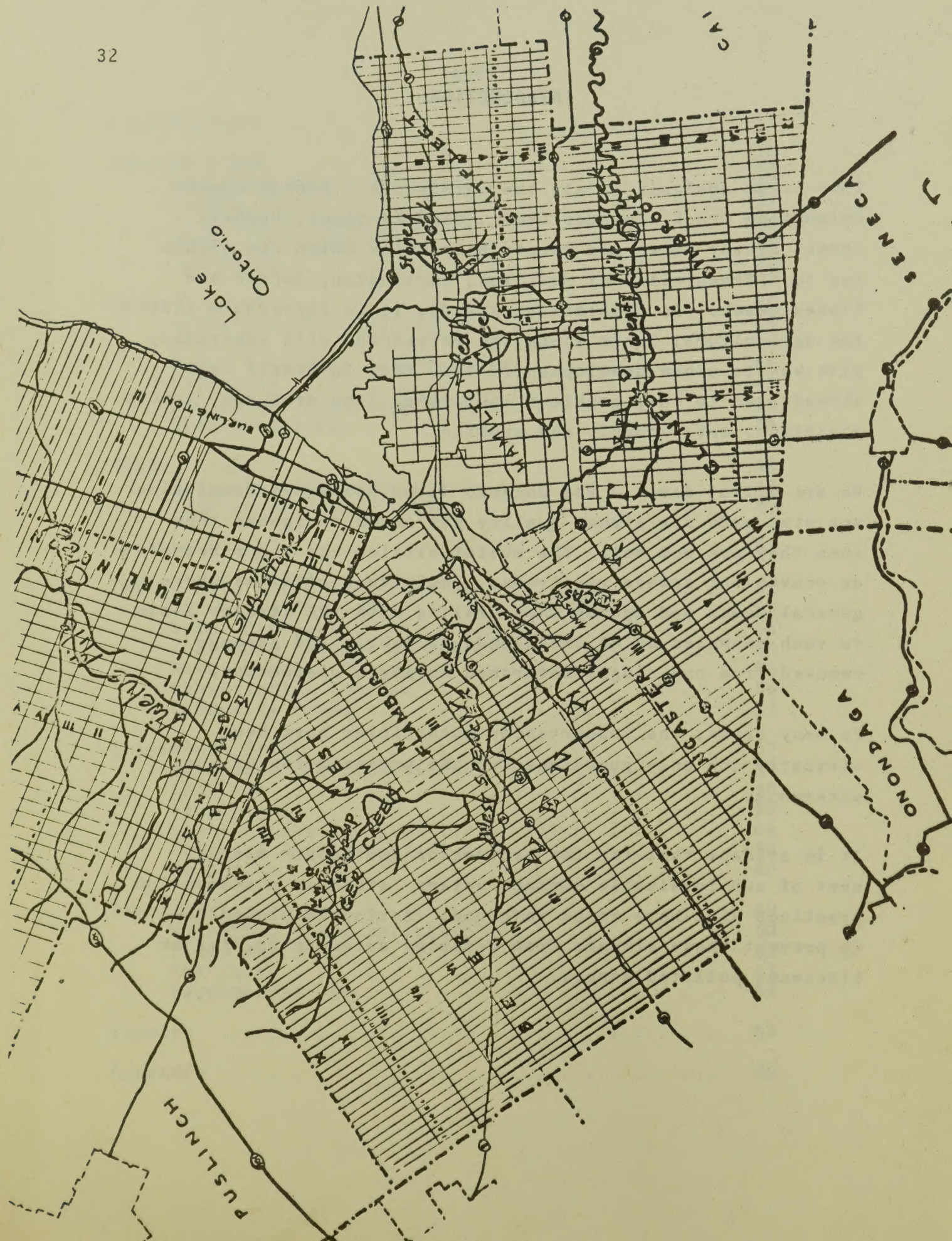
INTRODUCTION

This is an analysis of all the watersheds - Bronte Creek, Grindstone Creek, Spencer Creek, Chedoke Creek, Redhill Creek, Stoney Creek and Twenty Mile Creek which lie within ten to fifteen miles of Hamilton, Burlington, Dundas and Stoney Creek. As population expands, it is inevitable that the agricultural lands along the watersheds will eventually give way to urban development. This fact in itself has already led to many problems concerning land drainage, stream pollution, water supply and erosion.

We are all at fault. The Ontario Water Resources Commission set standards for stream quality but seems to ignore them when they are not met. The municipalities use the streams as convenient sewage receivers. Individual citizens whose general abuse and apathy when dealing with the streams leads to such examples as 40 truckloads of debris and garbage removed from one single watershed during a cleanathon.

In many cases, the Conservation Authorities have been virtually the only guardians for the preservation of our waterways.

It is evident that for the protection and proper management of our invaluable surface waters stricter conservation practices will have to be enforced. Action is needed now to prevent these streams from becoming dried-up gullies or lifeless, polluted sewers.



SPENCER CREEK

Watershed Characteristics

A detailed study was done on the Spencer Creek by the Spencer Creek Conservation Authority (later changed to Hamilton Region Conservation Authority) in 1960. A brief summary of the description of the watershed from this report follows:

The major creeks draining the watershed are Spring, Sulphur, Sydenham, Borer's Falls Creek, Ancaster, and the Spencer.

Spencer Creek's headwaters are the springs and seepage areas of the Galt moraine. After several miles, it is joined in the Beverly Swamp by an eastern branch which rises in the hills near Puslinch. The stream tumbles over the escarpment and is joined by several major tributaries which enter it from the east and west. Downstream from Dundas, Spencer Creek was canalized at an early date to give the town a navigable water route to the lake. Named the "Desjardins Canal" it is no longer used by commercial vessels.

Stream Flow

Several factors contribute to maintain the flow in streams - groundwater flow or base flow (percolation) and run-off are the two most important.

Numerous factors influence run-off. Terrain slopes, the actual watercourse slopes, soil permeabilities, ground cover, presence of lakes, and intensity of rainfall or snowmelt are just a few. Changing land use may alter some of these factors. For example, urbanization increases surface flow rates due to increased impermeable soil cover - rooftops, roadways, side-

walks, and storm sewers.

The Spencer Creek drainage basin has a more rapid surface run-off than normal. This is partially due to: a) the scarcity of bush and swamps in the escarpment zone and b) the high percentage of land covered with semi-impermeable and almost impermeable soils (56.5% semi-impermeable soils, 26.2% almost impermeable soils).

Discharge Measurements

Ontario Water Resources Commission continuously measures stream flow at a gauging station on Spencer Creek at the Dundas Crossing. In general the flow of the creek is like many in Southern Ontario - high discharge measurements are common in the spring and generally taper off to very low flows in the summer. In the fall, during rainy weather, flow increases again and drops off during the winter until spring break-up.

Flooding of Spencer Creek

Flooding in the Spencer Creek has not been extensive in the past. However, as changes in land use takes place such as clearing of land for agriculture and urban developments, the frequency and magnitude of floods could increase.

In other areas of the province much damage has been done not only to farm lands but to homes and factories which have encroached upon flood plains. Many people do not realize that the flood plains are watersheds, not areas to be developed as shopping centres, subdivisions, industrial complexes, etc. To protect these valuable plains it was suggested in the 1960 report of the Spencer Creek Conservation Authority that it have strict flood plain control regulations.

Flood plain mapping has been completed for Spencer Creek and flood plain control and planning is in effect. The Authority, under Section 20 of the Conservation Authorities Act has established regulations:

"prohibiting or regulating the construction of any building or structure in or on a pond or swamp or in any area below the high-water mark of a lake, river, creek or stream;
prohibiting or regulating the placing or dumping of fill of any kind in any defined part of the area over which the authority has jurisdiction in which in the opinion of the authority the control of flooding or pollution of the conservation of land may be affected by the placing or dumping of fill."

The Authority has gained the co-operation of Hamilton, Dundas and Ancaster to pass by-laws designating flood plain lands and restricting the use of these lands. In addition, the Authority receives copies of *all* proposed subdivisions and zoning changes before they are approved by the Municipal and Provincial Government. This gives them a unique opportunity to comment on developments thus helping to eliminate conservation problems in urbanized regions.

In many places where the flood plain has multiple value - recreational, historical etc. - the Authority tries to acquire the land. For example, the stretch of valley from the Christie Dam to Webster's Falls is presently included in a conservation scheme. An agreement was also finalized with Dundas regarding the development of flood plain land along Spring Creek. Under this agreement, Dundas donated its land holdings in the valley to the Conservation Authority. The Authority hopes to acquire the remaining flood plain land and has agreed to undertake a staged development of these lands in accordance with a Master Development Plan which was prepared by the Authority and approved by Dundas.

The 1960 Spencer Creek study cites two distinct flooding problems in Dundas:

1. flooding due to the spring break-up as the result of ice and snowmelt. This occurred mostly along the Main Branch of Spencer Creek. The flooding was often complicated by ice jamming, and
2. flooding due to heavy precipitation or severe local thunderstorms. This was associated with the Sydenham Creek. Flooding occurred where the creek had low banks, was obstructed or rapidly changed direction or grade. Even where there was little overbank flooding, the high creek velocities during storms resulted in costly damage to banks and retaining walls. Another problem was that the sediment removed during this erosion was deposited at downstream sections where the velocities were lower. This often produced culverts which were then unable to pass water before overtopping during the next period of high runoff.

Rechannelization has taken place in Dundas along Delsey Street. An underground conduit was placed along the street. This program, sponsored jointly by the Conservation Authority and the Town of Dundas, has greatly improved the flood situation. Approval was also given to Conservation Authority to undertake a detailed study of Spencer Creek in Dundas. The purpose of this study would be to determine existing channel capacities and erosion problems along the creek. The recommendations of this report when completed will be implemented (hopefully) in 1972.

Water Shortages

Although stream flow in 1960 was adequate for most of the year, the flow in the creek at Dundas in the summer reached low

levels. The Authority was also concerned that with population growth in the area, both domestic and possibly industrial usage of water would increase.

The Authority approached the problem by two methods:

1. a preliminary investigation was made of possible reservoir sites within the watershed. Topographic maps of the Spencer Creek Watershed were examined for possible surface reservoir sites and a total of seven were selected. Of these, Christie, Puslinch and Sydenham were surveyed in detail and contour plans of the damsites were prepared.
2. an attempt was made to maintain (and increase) the potential groundwater supplies. Groundwater is an essential part of the surface drainage as it supplements the flow in streams and rivers especially during periods of low precipitation. The reliability of the groundwater depends on the amount of water entering the soil during periods of precipitation and snowmelt. It was suggested that
 - a) practices such as contour ploughing strip-cropping, crop rotation, mulching, reforestation, and proper care of woodlots be advanced as these slow the rate of run-off and increase the volume of infiltration. They would also help to reduce flood flow peaks and soil erosion. Although the Authority does not undertake these practices itself, it offers free advice to land holders on such practices.
 - b) the headwaters of the streams, the Beverly Swamp in particular, be strictly controlled so that they produce steady stream flows. It was recommended that the Authority keep a close watch on any land-clearing projects and also ensure that a thorough study be made before any swamp areas are drained.

The Authority has kept strict control over the swamp and to date has acquired 1,143 acres as conservation lands. It hopes in the near future to obtain the entire swamp area - more than 2000 acres. These undertakings will insure that

this area continues to act as a vast natural water control device. It will also continue to support a multitude of wildlife species in their natural habitat.

Pollution

The Hamilton Region Conservation Authority through the use of the Municipal Laboratories in Hamilton as well as the Ontario Water Resources Commission* maintains a continuous record of water quality of Spencer Creek.

In the study of the Spencer Creek Watershed in 1960, it was noted that both the stream and the Desjardins Canal were subject to pollution at Dundas. The effluent from the Imhoff tanks of the Dundas Treatment Plant emptied (after treatment) into the Desjardins Canal. There was also sporadic pollution of the creek from various sources in Dundas and Greensville. The liquid effluent in the Canal had a high content of dissolved nutrients (particularly phosphates and nitrates) which would fertilize the water of the canal.

In the summer and fall of 1967, the O.W.R.C. conducted a pollution survey of the Town of Dundas and the creeks flowing through the town, these being the Spencer and Ancaster Creeks and the Desjardins Canal. Several interesting facts were reported:

1. septic tank disposal trucks were dumping there. During the survey, there was evidence of leachate from the towns dump at the east end of town was gaining access to the Desjardins Canal via a pond located in the dump. The dump received dry and

* For O.W.R.C. water quality objective see Appendix.

wet garbage and for a time sludge from septic tank disposal trucks.

2. in Spencer Creek of seventeen chemical samples taken the presence of phenols (petroleum products) were detected at two locations. Twelve of the samples were found to contain high concentrations of coliform organisms (3 being above the Commission's objective) and the presence of ABS* was found at eight locations.
3. in Sulphur and Ancaster Creeks of twelve chemical samples, the BOD** of one was higher than the objective and ABS was noted in eight samples. Of the fifteen bacteriological samples - twelve were found above the objective for coliform counts. A drainage tile was found to be discharging domestic waste to the stream on the Golf Links Road in Ancaster from evidence of the presence of ABS and high bacterial counts.
4. in the Desjardins Canal, of three chemical samples, the BOD of two were above the Commission's objective while all three showed the presence of ABS. Pollution of the canal was noted from the Dundas sanitary treatment plant outfall and a drain outlet from the dump.

Thus, in general, the survey showed that the creeks and the Canal were all carrying pollutant materials from various sources. Recommendations of the survey and the measures taken were as follows:

1. An inspection programme of the storm sewers was advised, to determine where pollutant materials were gaining access to the sewers and to remove these sanitary wastes from the drainage system. This measure was taken and the problem eliminated.
2. It was suggested that an investigation to determine and remove the source of oil pollution in Spencer Creek (as indicated by the presence of phenols) be carried out. The investigation was done but no source was found. However, there has been no recurrence of the oil.

* a component of detergents (Alkyl Benzene Sulforate)

** Biochemical Oxygen Demands

3. The Town of Dundas (based on recommendations from the O.W.R.C) instituted an Industrial Waste By-Law which would enable them to control the flow of harmful materials from industries to the sewer system.
4. It was recommended that the leachate from the dump be taken care of. The dump was sealed to prevent this material from getting to the drainage ditch and pond and thus making its way to the Canal. The outfall pipe from the treatment plant was also moved downstream due to the stagnant conditions of the Canal at its previous location.
5. The Town of Dundas expanded its sewage treatment facilities to remove 95 percent of the BOD and suspended solids.

The Ontario Water Resources Commission has continued its investigation of the stream. A summary of the water quality monitoring program for the years 1968 - 1970 is given in Tables 1, 2 and 3.

Using the coliform and BOD levels, we see that all the sample sites, except for the Valens Side Road Culvert, show evidence of severe pollution. Generally, the severity has increased from 1968 to 1970.

REDHILL CREEK

Watershed Characteristics

Redhill Creek consists of three main branches and several small streams. The watershed covers an area of 26.2 square miles and it lies mainly within Hamilton and Saltfleet. Small parts of the watershed lie within the Township of

TABLE NO. 1 - SPENCER CREEK

ONTARIO WATER RESOURCES COMMISSION WATER QUALITY MONITORING PROGRAM

Coliforms / 100 ml.	5 Day BOD p.p.m.	Total Solid p.p.m.	Susp. Solid p.p.m.	Turbidity	NH-3 p.p.m.	Total KJEL p.p.m.	NO-2 p.p.m.	NO-3 p.p.m.	Chol. p.p.m.	Tot. Iron p.p.m.
Spencer Creek (sample at Hwy. 102) October 1, 1967 to December 31, 1968										
maximum	190,000	4.6	652	242	325.0	4.20	0.10	2.00	29	2.78
minimum	148	0.8	310	3	3.1	0.01	0.00	0.01	1	0.30
average	21,502	2.2	415	40	29.0	0.33	0.01	0.65	20	1.21
January 1, 1969 to December 31, 1969										
maximum	78,000	7.0	2450	2050	60.0	0.30	0.03	1.50	122	50.00
minimum	212	0.6	300	3	3.5	0.01	0.00	0.13	14	0.35
average	9,923	2.1	491	110	14.6	0.11	0.01	0.69	31	7.00
January 1, 1970 to December 31, 1970										
maximum	1,690,000	3.5	520	160	90.0	0.29	0.04	1.50	56	2.10
minimum	148	0.6	250	5	3.0	0.02	0.00	0.08	17	0.25
average	103,088	2.0	419	23	17.5	0.10	0.01	0.75	31	0.85
Spencer Creek (sample at Valens Side Rd. Culvert)										
October 1, 1967 to Dec 31, 1968										
maximum	5,000	4.8	438	30	12.0	0.56	0.02	0.80	13	0.45
minimum	4	0.6	202	1	1.5	0.04	0.00	0.00	1	0.18
average	452	2.0	296	8	4.6	0.17	0.00	0.23	6	0.32
January 1 1969 to december 31 1969										
maximum	20,000	4.5	410	40	12.5	0.86	0.25	0.58	19	0.60
minimum	4	1.0	150	3	2.0	0.03	0.00	0.01	4	0.15
average	1,345	2.2	255	9	5.2	0.19	0.02	0.16	6	0.35
January 1, 1970 to December 31, 1970.										
maximum	16,000	8.0	375	25	30.0	0.40	0.19	1.30	39	0.81
minimum	4	0.8	200	5	2.0	0.01	0.00	0.01	5	0.05
average	1,231	2.9	280	8	6.9	0.20	0.02	0.15	9	0.43

TABLE NO. 2 - SPENCER CREEK WEST
ONTARIO WATER RESOURCES COMMISSION WATER QUALITY MONITORING PROGRAM

	Coliforms / 100 ml.	5 Day BOD	Total Solid p.p.m.	Susp. Solid p.p.m.	Tur- bidity	NH-3 p.p.m.	Total KJEL p.p.m.	NO-2 p.p.m.	NO-3 p.p.m.	Chlor. p.p.m.	Total Iron p.p.m.
Spencer Creek West											
(sample at Crooks Hollow Branch, west of Flamborough)											
October 1, 1967 to December 31, 1968											
maximum	4500.	3.4	562	46	21.0	1.00	2.50	0.03	1.30	19	0.85
minimum	20.	0.3	266	3	1.7	0.04	0.52	0.00	0.01	1	0.24
average	610.	2.1	367	13	6.1	0.28	0.99	0.01	0.51	12	0.43
January 1, 1969 to December 31, 1969											
maximum	118,000.	4.5	490	20	30.0	0.96	1.76	0.20	1.20	18	0.46
minimum	104.	0.8	260	5	2.0	0.03	0.40	0.00	0.13	5	0.25
average	7,139.	2.6	358	8	5.9	0.27	0.98	0.03	0.54	13	0.33
January 1, 1970 to December 31, 1970											
maximum	3,100,000.	60.0	2188	1760	60.0	12.00	20.00	0.08	1.50	117	0.70
minimum	24.	1.0	270	5	1.0	0.01	0.36	0.00	0.10	3	0.15
average	130,571.	4.7	466	103	13.1	0.67	1.85	0.02	0.59	19	0.35

TABLE NO. 3 - DESJARDINS CANAL
ONTARIO WATER RESOURCES COMMISSION WATER QUALITY MONITORING PROGRAM

	Coliforms / 100 ml.	5 Day BOD p.p.m.	Total solid p.p.m.	Susp. solid p.p.m.	Tur- bidity	NH-3 p.p.m.	Total KJEL p.p.m.	NO-2 p.p.m.	NO-3 p.p.m.	Chlor. p.p.m.	Total Iron p.p.m.
Desjardins Canal (sample at N. shore of Cr. above Conf. of Can.)											
October 1, 1967 to December 31, 1968.											
maximum	1,160,000.	40.0	892	53	45.0	24.00	*****	0.63	1.60	174	1.02
minimum	1,200.	2.2	530	3	4.0	0.08	2.80	0.00	0.00	3	0.26
average	133,081.	13.2	660	23	16.0	11.61	25.10	0.12	0.26	106	0.56
January 1, 1969 to December 31, 1969											
maximum	680,000.	24.0	780	90	40.0	26.00	45.00	0.30	1.70	146	1.30
minimum	2,700.	7.0	540	5	4.0	0.18	9.00	0.00	0.01	71	0.30
average	159,046.	14.4	653	32	15.2	12.26	20.71	0.09	0.36	111	0.77
January 1, 1970 to December 31, 1970.											
maximum	9,100,000.	80.0	1080	115	50.0	26.00	80.00	0.24	2.50	223	1.30
minimum	56.	2.0	450	5	3.0	0.01	0.60	0.00	0.01	4	0.30
average	205,000.	28.0	693	33	20.2	12.81	19.67	0.06	0.30	116	0.68

Glanford, Binbrook and the Town of Stoney Creek.

During the summer of 1967 the Hamilton Region Conservation Authority reviewed land use and hydrological and biological problems of the watershed. We have used this study as the basis for our review and updated parts where necessary.

Much of Redhill Creek consists of a limestone shelf overlain by shallow impermeable clay deposits which have been stripped of their tree cover. Because of this little precipitation can percolate to groundwater. This results in a high spring run-off and decreased summer flow from groundwater.

Redhill Creek's gradient varies from almost flat for the first two miles starting at the mouth, to gentle throughout the built-up area north of King Street, to steep from King Street to the escarpment where there is an 80 foot vertical rise. The gradient above the escarpment varies from mild to flat.

Streamflow

In the H.R.C.A. report (1967) there are no continuous records of streamflow. But it is noted that it can rise to flood proportions in a very short time and can dry up completely in places during summer periods.

Land Use

It is assumed that ultimately all lands within the watershed would be residential with the exception of one industrial area above Albion Falls and the neighbourhood and regional shopping facilities. This alone presents many problems with respect to the watershed as there are areas along the creek

which are subject to flooding. This could be intensified by the Niagara Escarpment whose steep face results in substantial runoffs during the spring and heavy rainfalls. In particular, any urban development at the toe of this slope may be vulnerable to flooding.

In the Redhill Creek report, it was suggested that to protect the watershed from unwise development:

1. The Hamilton Region Conservation Authority undertake floodplain zoning of the watershed (i.e. the flood potential of the valley lands be delineated and controlled solely by the Authority) and,
2. The Hamilton Region Conservation Authority solicit the co-operation of all member municipalities to help to control the use of flood plain lands.

Since 1967 the Conservation Authority has delineated the land which is to be protected under construction and fill regulations. In 1969 floodplain regulations were established and the Authority has control of all developments within the designated lands.

Water Shortages and Flooding

During the Redhill Creek study, reservoirs and channels were investigated to alleviate low summer flows and provide flood protection during the spring.

In considering storage reservoirs for physical control of water, it is desirable that they protect an area from flooding, store enough water to maintain good summer flows, and serve as recreation areas. Two possible sites were chosen: one near the north end of King's Forest Park and a second above the escarpment between Albion Falls and Highway 53.

In 1969, the H.R.C.A. began acquisition of the land required for the second (Highway 53) reservoir. However, after an inquiry, the Minister of Energy and Resources (now the Department of the Environment) refused approval to expropriate all the needed land. A new scheme was devised and land requirements were altered. Some land for the new plan has been bought and at present the Authority is negotiating with land-owners for another 90 acres. The new scheme will provide physical regulation of the stream and a much-needed recreational area.

Much of the flooding along Redhill Creek was due to restricted natural channel capacity and inadequate bridge openings where roads cross the valley. Although there was little risk of major flood damage, some of the road structures could have been severely damaged during a heavy storm. The Hamilton Region Conservation Authority reviewed the situation with the Engineering Department of Hamilton. The Engineering Department undertook a program to renew many of the bridge structures and, in some areas along the creek, buried the channel in an enclosed box to free the surrounding lands for development. The program agreed reasonably well with those recommended by the Authority.

Pollution

Pollution of Redhill Creek is being investigated by the Ontario Water Resources Commission. There are two major sources:

1. poor sanitary landfill operations near the mouth of the creek and above the escarpment between the C.N.R. tracks and Upper Ottawa Street. Surface run-off from heavy storms has carried a significant amount of garbage from these sites into the stream. Leached material has also been seen flowing from the landfill directly into the stream.
2. overflow from the combined sewer system in the City

of Hamilton. Storm sewers on Barton Street, Queenston Road, and King Street all discharged effluents into the creek during times of high runoff.

In 1967 the O.W.R.C. began a survey of the sewer outfalls and tributary streams to Hamilton Bay. Samples taken from Redhill Creek and the sewer outfalls indicated organic pollutants, probably of a domestic nature. It was stated that the pollutants in the King Street sewer may have been due to by-passed sewage. However, the other sewers had no known by-pass connections and should not have been carrying pollutants.

It was noted that as Redhill Creek passes the Upper Ottawa refuse disposal site it picks up organic matter. At a number of places 5-day BOD values were recorded as 9, 82, and 90 ppm. Phenols were also high. Through dilution the levels decreased in the downstream direction. Detergents were found in all of the stream samples indicating that domestic sewage is entering the stream from unknown sources. Faecal coliforms, attributable to human excrement, were also present in quantities ranging to 26,000 per ml. representing a *potential health hazard in Redhill Creek*.

Samples taken upstream from the refuse disposal site also showed domestic wastes. This may be caused by faulty tile beds in the area.

The recommendations stated by this investigation were as follows:

1. The City of Hamilton should investigate the sewage and storm sewer systems to establish a programme which will reduce to acceptable levels the amounts of pollutants presently gaining access to Hamilton

Bay and tributary streams, and,

2. The City of Hamilton should continue to investigate means by which water pollution caused by the refuse disposal areas can be eliminated.

In personal communication with Mr. John Coates of the Hamilton Region Conservation Authority, it was found that the situation has not been remedied by the City. Although the City plans to discontinue the use of the Ottawa Street Dump, it is still operating and the pollutants are still gaining access to the stream.

Evidence from Ontario Water Resources Commission quality monitoring programme for the years 1968 - 1970 shows that the stream is still polluted. (see Table No. 4).

Biological Investigations

During the summer of 1967 a survey was made to assess the influence of the Ottawa Street Dump on the biological condition of Redhill Creek. Almost all visual field observations and final fish and invertebrate tabulations suggested that Redhill Creek was extensively disrupted biologically above the falls and around the dump. The diluting action of added water and then the aeration at Albion Falls minimized the effects beyond the dump. Such was the situation in 1967 which it was stated in the report, was expected to deteriorate.

Recommendations

1. As was suggested first in the Conservation Study of Redhill Creek and again in the O.W.R.C. survey of pollution within the City of Hamilton, two major measures should be undertaken to help the quality of the stream:
 - a) the combined sewer system of the City should be

TABLE NO. 4 - REDHILL CREEK

ONTARIO WATER RESOURCES COMMISSION WATER QUALITY MONITORING PROGRAM

	Coliforms / 100 ml.	5 Day BOD p.p.m.	Total Solid p.p.m.	Susp. Solid p.p.m.	Tur- bidity	NH-3 p.p.m.	Total KJEL p.p.m.	NO-2 p.p.m.	NO-3 p.p.m.	Chlor. p.p.m.	Total Iron p.p.m.
Redhill Creek (sample at Beach Road, Hamilton)											
October 1, 1967 to December 31, 1968.											
maximum	*****	100.0	684	208	120.0	9.00	28.10	0.55	2.10	161	5.80
minimum	4.	3.9	456	17	10.0	0.00	1.20	0.00	0.00	2	0.55
average	20,361,071.	31.2	583	49	43.8	4.61	10.35	0.09	0.41	91	2.62
January 1, 1969 to December 31, 1969.											
maximum	*****	103.0	780	230	100.0	9.30	22.00	0.56	1.40	122	6.40
minimum	4.	6.5	440	20	15.0	1.40	2.70	0.00	0.00	42	1.85
average	20,421,638.	36.6	555	47	37.8	5.53	10.36	0.11	0.41	91	3.48
January 1, 1970 to December 31, 1970.											
maximum	17,000,000.	180.0	1850	1020	80.0	8.50	18.00	0.28	1.70	232	6.40
minimum	4.	1.4	350	5	4.0	0.03	0.72	0.00	0.01	5	0.35
average	2,505,139.	38.9	618	122	34.3	5.20	7.74	0.08	0.72	101	2.58
Redhill Creek (sample below sanitary landfill site)											
October 1, 1967 to December 31, 1968											
maximum	156,000.	4.1	1068	294	300.0	1.57	2.90	0.11	3.40	149	8.40
minimum	8.	0.4	376	1	1.4	0.02	0.00	0.00	0.01	2	0.07
average	7,267.	1.7	722	39	30.9	0.39	0.98	0.02	1.27	100	2.05
January 1, 1969 to December 31, 1969											
maximum	9,300.	4.5	1240	90	50.0	1.50	2.40	0.12	5.40	235	0.75
minimum	4.	0.8	340	1	1.0	0.01	0.35	0.00	0.01	30	0.08
average	1,410	1.7	736	9	6.4	0.31	0.89	0.02	1.71	125	0.24
January 1, 1970 to December 31, 1970											
maximum	2,900,000.	28.0	7400	6530	110.0	17.00	36.00	0.08	9.00	223	8.00
minimum	8.	0.4	210	5	1.5	0.01	0.36	0.00	0.01	6	0.05
average	124,531	3.4	1056	286	11.2	1.03	3.13	0.02	2.26	143	1.19

altered so it does not flow into the creek.

- c) the Upper Ottawa Street refuse site should be discontinued by the City or it should be sealed to prevent leachate and garbage from gaining access to the creek.
- 2. Investigations should continue as to other possible sources of pollution in the stream, and if found, remedied.
- 3. Close co-operation between the City of Hamilton and the Hamilton Region Conservation Authority so that development in the watershed is orderly.

We feel that if these measures are not undertaken by the City, pressure should be put on them (i.e. fines) by the Ontario Water Resources Commission. The stream has been disrupted biologically by these sources and at times, according to the O.W.R.C., is a potential health hazard.

STONEY CREEK

Watershed Characteristics

Stoney Creek has a drainage area of about 11.2 square miles. It flows into Lake Ontario (at the Confederation lagoon) at the Queen Elizabeth Highway south of the town of Stoney Creek. At Barton Street the stream divides into a west and east branch. The total length of the stream (east and west branches) is about 6 miles. During the summer the streamflow is very, very low or it dries up completely.

Studies of the Stoney Creek

In 1969, the Hamilton Region Conservation Authority retained Foundation of Canada Engineering Corporation Ltd. to carry out a preliminary study of those portions of Stoney Creek

located within the town of Stoney Creek. The creek was causing substantial erosion and erosion-related problems.

Early in 1970, the preliminary report was completed. It recommended that certain sections of the creek be re-channelled and that minor improvements be undertaken in other sections to facilitate the flow during peak flow conditions. It was also recommended that control structures above the Town of Stoney Creek be installed to control the flow of the creek during peak flow.

Construction is to be undertaken on a priority basis.

Stoney Creek was studied by the Municipal Labs at a sampling station at Queen Elizabeth Way where the creek enters Confederation Lagoon. The coliform counts, phosphates and ammonia levels have decreased markedly since the installation of Stoney Creek sewage lines into the Hamilton sewage treatment plant.

Further upstream at a sampling station between Barton and King Streets the coliform had been reduced to reasonable levels but the east branch of Stoney Creek had higher levels of coliform, ammonia and phosphates.

In times of storms or prolonged rain the sewers can't handle all the run-off. The excess in the sewers goes into Stoney Creek. Although it is diluted, it is still a source of untreated pollution contaminating the creek.

At Lake Ontario Stoney Creek forms the Confederation Ponds east and west. These ponds receive drainage from the ditches of the industrial area just south of the Queen Elizabeth Way.

The east pond was tested on 13 occasions and the coliform level was found to be under the acceptable level set by O.W.R.C., 50% of the time. Fecal coliforms which indicate human sewage were not a high percent of the total coliform count. The ammonia, nitrates and phosphates however, were appreciably higher in the summer months when water levels are lower and had less capacity to dilute the sewage.

The west pond was also tested on 13 occasions. The report was much the same as the east pond but it was noticeably cleaner. Gas rising from the bottom was also observed and the dissolved oxygen levels were lower than they should have been indicating a large amount of bacteria action. The following figures are considerably higher than the O.W.R.C. objectives.

	COLIFORMS	FECAL COLIFORMS	AMMONIA	PHOSPHATES	CHLORINE
EAST POND	9,000	150	.14	.48	86
WEST POND	20,000	600	.26	.60	87

CHEDOKE CREEK

Chedoke Creek is becoming a drainage area for storm sewer outfalls. Much of the creek has been diverted from its original natural cut channel into man made channels and culverts as it empties into Cootes' Paradise. It was tested by the O.W.R.C. in 1966 to determine the amount of sewage it contributes to the Bay. The most significant factor was the presence of industrial wastes near its entrance into Cootes Paradise. Traces of detergents were also found indicating the presence of domestic wastes in the stream.

In a later study prepared by the Hamilton Region Conservation

Authority the following data was collected on the quality of Chedoke Creek. These can be compared to the O.W.R.C. standards so that they have more meaning.

	COLI-FORMS	NITRATES	PHOSPHATES	ALKALINES	HARDNESS	CHLORIDES
1968	26,200	.75	.33	120	209	34
1970	5,600	2.20	.37	137	248	53

TWELVE MILE CREEK (BRONTE CREEK)

Watershed Characteristics

The watershed of Bronte Creek is 119.8 square miles. The stream is 22 miles long and the headwaters are located just north-east of Morriston at an elevation of 1,050 feet above sea level. Above the Niagara escarpment the basin is heavily wooded with swamps and ponds in several places. Most of the small streams and tributaries receive their flows from springs. Below the escarpment the land is rolling and relatively well cleared. Livestock farming has become the principal activity in the basin.

The stream gradients are high and are established in three intervals: a) from source to Flamborough - 15 ft./mile, b) from Flamborough to the base of the escarpment - 59.5 ft./mile, and c) from the escarpment to Lake Ontario - 25.5 ft./mile.

These steep streams have high velocity flows with strong erosive powers. Although there are eight very small lakes or "kettle ponds" within the watershed which reduce the run-off rates in the tributaries their effect on peaks in the main streams is not appreciable.

Seventy percent of the watershed is classified as "permeable soils" - sands, gravels, moraines, and some limestone plains, 20% of the watershed is "semi-permeable" - imperfectly drained soils and some clay and 10% of the land is "almost impervious" poorly drained soils, tight clay lands and urban areas.

Discharge Measurements

The O.W.R.C. has established a continuous streamflow gauging station of the creek. A summary of the measurements for the years 1960 - 1969 was obtained:

mean annual discharge:	92.6	cubic feet per second
high	: 764.0	"
low	: 5.4	"

Thus the stream has a very high velocity and at times flows very fast, while at other periods it is reduced to low flow conditions.

Water Problems of the Creek

Flood damage along the Twelve Mile Creek has been minor in the past. However, there are certain flood-vulnerable areas. As the population increases within the watershed, housing and development may encroach upon the flood plains. It was suggested in the Twelve Mile Creek Conservation Report in 1960 that much future flooding could be eliminated early by delineating the flood-vulnerable areas and promoting uses of these areas which did not involve a flood damage hazard. Thus "flood-plain zoning and control" was strongly advised.

The Halton Region Conservation Authority has now completed floodplain mapping for the creek from Lake Ontario to Upper Middle Road. By 1974 the Authority expects to have flood-plain mapping completed for the whole of Twelve Mile Creek.

The Flood Problem at Morriston

Morriston lies astride and near the headwaters of a tributary of the creek. In 1960 it was reported that for many years the water has ponded along this reach, causing considerable inconvenience. Because the drainage is poor, the ground remains in a saturated condition during heavy rains or rapid snowmelts. The water floods the yards of the homes nearby, fouls gardens and septic tanks and sometimes floods basements. It was suggested that to improve the situation two things could be done:

- a) use above the ground and underground field tile and
- b) make use of a small 10.9 acre lake on the west boundary of Morriston.

We were informed by Mr. Murray Stephen of the Conservation Authority that although this programme was adopted by the old Twelve Mile Creek Conservation Authority in 1962, it was never carried out because of land assembly problems and local opposition. To our knowledge the situation has not been remedied.

Water Erosion Control

Generally, there appeared to be three types of erosion of the soil by water occurring along the creek in 1960:

1. tremendous quantities of soil are removed downward from bare banks along roadway cuts during rainstorms. Not only is the soil lost from its structural position, but it settles out in flatter areas to fill culverts and pools; it can cover crops and cause pollution of the stream.

The solution proposed was quite simple and relatively inexpensive - vegetation of the banks. It was suggested that the Conservation Authority could co-operate with the Works Department of the Municipalities to carry out road bank erosion control.

2. there were accounts of bald, rapidly eroding banks where gas pipelines crossed the creek. Here again the ravine wall could be restored to vegetative productivity.
3. it was found that gully erosion was occurring throughout the watershed. In some places these gullies were the outcome of a drainage diversion. The Authority was encouraged to examine gully erosion and undertake measures to remedy present instances and prevent future ones.

At present the Halton Region Conservation Authority has completed grass waterways across agricultural fields as demonstrations of erosion control. It reviews proposals for road widening and construction and suggests areas and means of stabilizing road cuts to control erosion. Technical assistance is provided where necessary to assist in controlling soil run-off.

Conservation Storage

As with all the other streams in the area, Twelve Mile Creek suffers from low supply during the summer period and high flows during spring break-up. To improve this situation, an investigation of reservoir sites was undertaken. Five sites were selected which had potential to store large volumes to meet requirements for flood control and water supply.

Of the five reservoir sites suggested (Ash, Zimmerman, Strabane, Freelton, and Montsberg) only the Montsberg reservoir has been constructed. For the others the cost per acre foot of storage was excessive and the soil borings taken for the dam sites indicated problems would arise with seepage. At this time there are no plans to construct additional reser-

voirs on the Twelve Mile Creek.

Community Ponds

In the 1960 Conservation report it was suggested that the Authority prepare a program to develop community ponds. Community ponds, like farm ponds, are good water storage reservoirs and help conserve run-off water. Community ponds also provide habitat for wildlife - fish, waterfowl, muskrats etc. As well, they have aesthetic value which cannot be easily measured in dollars and cents.

In the Conservation study, four sites were strongly recommended. Of these only one (at Carlisle) has been constructed by the Authority.

Pollution

Unfortunately, we were not able to determine if there were any pollution studies done for the Twelve Mile Creek. We would strongly recommend that a quality monitoring programme be set up for this creek by the O.W.R.C. or by the Conservation Authorities.

GRINDSTONE CREEK

Watershed Characteristics

The Grindstone Creek watershed has an area of 34.4 square miles. It follows a winding course above the Village of Waterdown, crossing Highway #6 twice near the Hamlet of Millgrove. Below the junction the creek shares its valley with the Canadian Pacific Railway and passes south-easterly through Waterdown in a deep ravine. The creek passes under Highway 403 via Hidden Valley, passes through a deep valley known as

Hendrie Park and into Hamilton Harbour south of Highway 2.

Discharge Measurements

In 1966 the Ontario Water Resources Commission established a continuous streamflow gauging station on the stream. Calculations of their records are:

mean annual discharge	:	25.0	cubic feet per second
high	:	266.0	"
low	:	0.6	"

Like the other streams, flow is highest in the spring and lowest during the summer. Flood threats can be ignored except during heavy storms and in the spring break-up.

Land Use

Above the escarpment most of the land in the watershed is used for agriculture. About 4,500 acres is of low productivity because of poor drainage and adverse soil conditions; the remainder is amongst the best farm land in the Hamilton-Wentworth area.

Below the escarpment and north of Aldershot, gully erosion along tributary streams has produced deep ravines and has led to mixed use of the land. Several of the ravines have been reforested and bank erosion is now a minor problem. Land use between the ravines is partly residential and partly agricultural, except along Highway 403, where it is industrial.

Due to increasing population and the expanding municipalities in the watershed, it is inevitable that agriculture will eventually give way to urban development. Problems can then be expected to increase with land drainage, stream pollu-

tion, water supplies, and erosion.

Flooding

The main flood threat is to residents along a short section of the valley upstream from Highway 403. Flooding of Hidden Valley Park in Burlington occurs as the result of ice jams at the road bridge near the swimming pool and ponding has affected buildings there. Flooding of the valley owned by the Royal Botanical Gardens is also seasonal.

Low Flow and Conservation of Water

During a groundwater survey by the O.W.R.C. for the Village of Waterdown, it was found that water supplies in the catchment area were not sufficient to meet the demand placed on them. As the population in the area increases and as irrigation demands increase it was felt that this situation would become worse.

Proposed Improvements

The 1965 report of Grindstone Creek made several recommendations. Where information was available we have commented on the present status of the recommendation.

1. to control development and landfill operations within the flood vulnerable lands of the watershed, it was suggested that the Conservation Authority undertake floodplain zoning regulations for the creek. (Floodplain mapping will be completed on the Grindstone Creek from Lake Ontario to Waterdown by September 1971. The Authority program from 1971 to 1974 inclusive will have flood plain mapping for the Grindstone Creek completed.)
2. since most of the catchment area above the escarpment was classed as good agricultural land, the construction and proper management of land drainage was encouraged.
3. the sandy loam and clay loam soils which occurs in the

watershed are easily eroded, and require careful agricultural practices to prevent sheet erosion and gully erosion. Standard practices such as crop selection, grassed waterways, contour ploughing and reforestation were recommended as conservation measures.

4. where topography was a limitation on soil capability, and gully erosion was a danger, it was recommended that these be controlled by maintaining tree cover in ravines, by flood control works and by channel improvements as applicable. It was recommended that restrictions be placed on the removal of trees in ravine areas and where necessary the Authority acquire private ravine lands.
5. channel improvements were proposed. Some of these consisted of gabions constructed at points of erosion and the replacement of inadequate culverts.
6. four reservoir sites were surveyed and studied comparatively and the most feasible sites were given cost estimates.
7. a system for the establishment of farm ponds at suitable locations for conservation storage was recommended.

Pollution

The O.W.R.C. have established a monitoring program for the Grindstone Creek. Their results for the years 1968-1970 can be found in Table 5.

Although the Grindstone Creek is not severely polluted, the coliform counts are very high. The sources of pollutants should again be investigated and corrected.

TWENTY MILE CREEK

Watershed Characteristics

In the Niagara Peninsula, Twenty Mile Creek has the largest drainage area of all the creeks flowing into Lake Ontario,

TABLE NO. 5 GRINDSTONE CREEK

ONTARIO WATER RESOURCES COMMISSION WATER QUALITY MONITORING PROGRAM

Coliforms / 100 ml.		5 Day BOD p.p.m.	Total Solids p.p.m.	Susp. Solids	Turbidity	NH-3 p.p.m.	Total KjEL p.p.m.	NO-2 p.p.m.	NO-3 p.p.m.	Chlor. p.p.m.	Total Iron p.p.m.
Grindstone Creek (sample at Waterdown Road, Waterdown)											
October 1, 1967 to December 31, 1968											
maximum	1,600,000	10.0	568	94	65.0	0.52	2.80	0.12	2.57	222	3.70
minimum	190	0.8	238	2	2.5	0.03	0.58	0.00	0.20	1	0.41
average	144,143	2.8	435	22	16.4	0.17	1.13	0.02	1.18	33	1.54
January 1, 1969 to December 31, 1969											
maximum	810,000	6.0	520	250	150.0	0.44	2.40	0.03	2.50	33	1.60
minimum	200	0.6	270	2	2.0	0.01	0.37	0.01	0.43	14	0.30
average	46,550	2.7	406	25	16.6	0.12	1.10	0.01	1.44	23	0.79
January 1, 1970 to December 31, 1970											
maximum	17,300	11.0	1340	1020	30.0	0.15	1.80	0.12	3.40	226	2.10
minimum	216	0.4	280	5	3.0	0.01	0.32	0.00	0.54	18	0.20
average	5,003	2.3	475	52	10.3	0.05	0.83	0.02	1.60	39	0.72
Grindstone Creek (sample at Highway No. 2)											
October 1, 1967 to December 31, 1968											
maximum	88,000	11.0	654	160	100.0	0.55	2.10	0.12	2.00	85	3.80
minimum	28	1.4	282	10	5.6	0.04	0.46	0.00	0.10	1	0.52
average	10,086	3.6	475	54	40.1	0.21	1.18	0.03	0.84	37	2.62
January 1, 1969 to December 31, 1969.											
maximum	7,000,000	12.0	570	210	200.0	0.50	4.20	0.08	2.20	48	4.00
minimum	70	1.4	340	10	2.0	0.01	0.70	0.01	0.02	16	0.90
average	342,082	3.8	442	51	40.9	0.18	1.47	0.03	1.06	32	1.96
January 1, 1970 to December 31, 1970.											
maximum	6,400	16.0	700	145	80.0	0.58	2.00	0.20	3.70	119	2.55
minimum	40	0.8	320	5	10.0	0.01	0.40	0.00	0.13	24	0.15
average	1,514	4.0	513	54	36.5	0.13	1.17	0.04	0.99	53	1.54

(122.2 square miles). All except four square miles lie above the escarpment. The watershed is roughly crescent-shaped with an overall length of about 34 miles and a maximum width around Smithville of about 6.5 miles.

The creek rises in the south-west corner of Hamilton and meanders eastward in a shallow valley across a clay plain to the escarpment. About one mile south of Highway 8 the creek drops 85 feet over the escarpment at Ball's Falls into a narrow scenic gorge. At this point it turns northward and flows across the fruit belt for about three miles to Lake Ontario at Jordon Harbour.

Discharge Measurements

Measurements of streamflow have been recorded by manual staff gauges at Ball's Falls by the Niagara Region Conservation Authority since 1957. In the report of the Authority in 1964, the flow was described as follows: from its maximum discharge in the spring the stream drops quickly to moderate flows in early summer and often to nearly zero flow for long periods in the late summer and early fall.

The O.W.R.C. has established a continuous recording station here also for streamflow measurements. Their records are summarized:

mean annual discharge	:	84.2	cubic feet per second
high	:	2440.0	"
low	:	0.0	"

In 1964, a study was undertaken to locate possible sites for conservation water storage on the creek to overcome the problems of low flow during the summer. Five possible sites were located along the creek. These were surveyed in the

field and a preliminary engineering study carried out. Of the sites examined only two appeared to be practical: St. Anne Dam and reservoir and Fulton Dam and reservoir. A series of low wiers were also suggested at existing control points where bedrock outcrops occurred. These wiers would have created a continuous series of deep pools.

To date neither the reservoirs nor the wiers have been constructed. It appears that the Niagara Region Conservation Authority has no plans to initiate development of this nature on the Twenty Mile Creek.

Flooding

Flooding in the Twenty Mile Creek has not been extensive in the past, but in view of rapid population growth and development in the area, it was strongly suggested that the Authority undertake a program of "flood plain zoning." Thus, the flood plains would be protected and if a flood did occur, the results would be less severe.

Unfortunately, no flood plain mapping or regulations have been established by the Authority.

Pollution

In 1968, a water pollution survey was undertaken by the O.W. R.C. in the Township of Binbrook. Included were a number of sample sites on Twenty Mile Creek. Analysis revealed that the BOD and coliform counts at a number of locations exceeded the Commissions objective. Where the creek parallels Highway 20 at County Road it was particularly severe, but the reason was unknown. Downstream from this location, run-off from the Gos-Gris and Paron Cheese properties was adding pollutant waste to the stream. Manure wastes were also entering the stream from a piggery in Concession III.

Recommendations

1. We feel that the Niagara Region Conservation Authority is not as effective as it could be in proper stream management. They should receive support from the local municipalities and the Ontario Government to undertake updated studies on flooding, low flows and conservation storage within the watershed.
2. Floodplain mapping and regulations similar to the Hamilton Region Conservation Authority's program should be established for the Twenty Mile Creek in the near future.

SUMMARY

At present, all the creeks in Wentworth and Halton Counties have been and are now polluted to varying degrees. Most have been poorly planned at various times with regard to flood plain control, erosion, and water shortages.

Within the report, certain specific recommendations were stressed with regards to each individual stream. However, certain general situations are obvious and we feel these should be mentioned:

1. All the data accumulated by the O.W.R.C. Quality Monitoring Program and many individual studies show evidence of pollution. In certain instances (like the Redhill Creek), the offenders are known. We strongly feel that where there is documented evidence of a known polluter, the O.W.R.C. should use its powers and have the source cleaned up. Heavy fines should be levied, if necessary, if offenders do not abide by the Commission's directives.
2. We feel there should be closer co-operation between the O.W.R.C. and the Conservation Authorities. A system such as the one operating in the Hamilton Region Conservation Authority, where the Authority takes the stream samples and then sends them to the O.W.R.C. laboratories in Toronto to be analyzed, would be very effective. Since the Authorities deal with the streams year round, they are very

familiar with the changes that might occur and with present and possible future pollution sources.

3. The Conservation Authorities that do not yet have flood plain regulations should establish these as soon as possible. (The Niagara Conservation Authority).

ONTARIO WATER RESOURCES COMMISSION
(Significance of Laboratory Analysis)

Bacteriological Examination

The presence of coliforms indicates pollution from human or animal excrement, or from some non-faecal form. The objectives for surface water quality in Ontario is a maximum of 2400 organisms per 100 millilitres.

Sanitary Chemical Analysis

1. Biochemical Oxygen Demand (BOD)

Biochemical Oxygen Demand is reported in parts per million (p.p.m.) and is an indication of the amount of oxygen required for the stabilization of decomposable organic or chemical matter in water. The completion of the laboratory test requires five days under the controlled incubation temperature of 20 degrees Centigrade.

The Commission's water quality objectives are

- i) for stream water - a 5-day BOD of not greater than 4 p.p.m.
- ii) for storm sewer, water pollution plant and industrial waste discharges - a 5-day BOD of not greater than 15 p.p.m.

2. Solids

The laboratory does tests to determine the total and suspended solids in a sample. The value for dissolved solids is determined by taking the mathematical difference between the total and suspended solids.

The concentration of suspended solids expressed in parts per million (p.p.m.) is generally the most significant of the solids analyses in regard to stream water and outfall discharge qualities.

The O.W.R.C.'s objective for discharge is a suspended solids concentration of not greater than 15 p.p.m.

3. Nitrogen

Ammonia Nitrogen, sometimes called free ammonia, is

the insoluble product in the decomposition of nitrogenous organic matter. It is also formed when nitrates and nitrites are reduced to ammonia either biologically or chemically. Some small amounts of ammonia, too, may be swept out of the atmosphere by rain water.

The following values may be of general significance in appraising free ammonia content: low, 0.015 to 0.03 to 0.10 p.p.m.; high, 0.10 or greater.

4. Total Kjeldahl

This is a measure of the total nitrogenous matter present except that measured as nitrite and nitrate nitrogens. The Total Kjeldahl less the Ammonia Nitrogen measures the organic nitrogen present. Ammonia and organic nitrogen determinations are important in determining the availability of nitrogen for biological utilization. The Normal range for Total Kjeldahl would be 0.1 to 0.5 p.p.m.

5. Nitrite Nitrogen

Nitrite is usually an intermediate oxidation of ammonia. The significance of nitrates, therefore, varies with their amount, sources, and relation to other constituents of the sample, notably the relative magnitude of ammonia and nitrate present. Since nitrite is rapidly and easily converted to nitrate, its presence in concentrations greater than a few thousandths of a part per million is generally indicative of active biological processes in the water.

6. Nitrate Nitrogen

Nitrate is the end product of aerobic decomposition of nitrogenous matter, and its presence carries this significance. Nitrate concentration is of particular interest in relation to the other forms of nitrogen that may be present in the sample. Nitrates occur in the crust of the earth in many places and are a source of its fertility.

The following ranges in concentration may be used as a guide: low, less than 0.1 p.p.m.; moderate 0.1 to 1.0 p.p.m.; high, greater than 1.0 p.p.m.

7. Anionic Detergents as ABS (Alkyl Benzene Sulfonate)

The alkyl benzene sulfonate portion of the anionic detergents is reported in p.p.m. The test is generally employed to indicate the presence of illegal discharge to wastewater to storm drains. Thus it is an indication that domestic waste is present.

8. Phenols

The presence of phenol or phenolic equivalents is generally associated with discharges containing petroleum products, or with wastes from industries. It is generally conceded that adequate protection of surface waters will be provided if the concentration of phenols in waste discharges does not exceed 20 parts per billion (p.p.b.). Phenolic type wastes can cause objectionable conditions in water supplies and might taint the flesh of fish.

9. Iron

Water for domestic use should contain less than 0.3 parts per million of iron in order to avoid objectionable tastes, staining and sediment formation. Iron concentrations of not greater than 17 parts per million in waste discharges should permit adequate protection of surface waters.

10. Turbidity

Turbidity associated with waste inputs should not exceed 50 Jackson units in warm-water streams or 10 Jackson units in cold-water streams.

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CHAPTER THREE

GROUND WATER

linda hastie

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INTRODUCTION

Groundwater is that which occurs below the surface of the ground in the zone of saturation where all pore spaces and fractures are filled with water. The surface of the saturated zone which may be close to or far below the land surface is called the water table. A formation which will hold, transmit, and yield groundwater in useable quantities is known as an aquifer.

Precipitation in the form of rain and snow is the main source of groundwater. In general, approximately forty percent of all precipitation becomes surface runoff and groundwater. The rest is returned to the atmosphere by evaporation from the soil and open bodies of water and by transpiration from vegetation.

Precipitation averages over 30 inches annually in most parts of Southern Ontario. Forty percent of this amounts to 174 million gallons on each square mile of land surface and generally less than one half of this is available as ground water through infiltration before it discharges to streams or lakes. In sandy areas the rate of infiltration is higher than in clay areas and the amount of water available for ground water recharge is correspondingly greater. Other factors such as the intensity of rainfall, the nature of soil and vegetation cover, the slope of land surface and the wind and temperature conditions all play an important part in governing the amount of water entering the groundwater system.

GROUND WATER MOVEMENT

Groundwater, acting largely under the influence of gravity and the pressure of surrounding water, continually seeks areas of lower pressure or lower potential energy and follows complex pathways through the materials of the earth. Some does not travel far before it returns to the surface, some travels to great depths and remains underground for long periods, but all is eventually discharged on the surface or into streams, lakes or the ocean from where it is again evaporated and continues in the cycle.

The rates of groundwater flow depend on the hydraulic gradient and on the permeability of the materials. Actual rates of movement vary from almost zero to a maximum of more than 100 feet per day, but a normal range is from 5 feet per year to 5 feet per day. These low velocities combined with the vast storage available in the geological materials of the earth combine to reduce the variations in groundwater flow to a minimum. Thus, whereas the water-table may fluctuate rapidly, depending upon the precipitation, deeper parts of groundwater flow systems will vary much more slowly.

Small rapid variations in the level of the groundwater-table can be caused by any force that affects the materials in which it occurs, such as vibrations from traffic, earthquake forces, crustal tide forces and air pressure changes. Longer term fluctuations are due to variations in supply of recharge water and are more likely to be seasonal. Fluctuations in the water table are also caused by man's interference with any part of the flow system by pumping, irrigation and drainage, altering river or lake levels, changing or removing the natural cover and many other causes.

In general, throughout Ontario, recharge is greatest and groundwater levels are highest during spring break-up. From this peak they fall gradually to a low late in summer; only prolonged and widespread rainy periods during the summer will reverse the trend as most summer precipitation is returned to the atmosphere by evapotranspiration. The lowest levels are reached in the early autumn. The autumn rains come when evapotranspiration is at a minimum and considerable recharge takes place. Generally, the water-table will rise until freeze-up after which most precipitation is in solid form and little soaks into the ground. During the winter there is a gradual falling of groundwater levels until spring break-up occurs again.

The amount of water which can be removed in any specific area depends on many factors. For example, fine-grained materials such as clay or silt have high porosities and abilities to hold large quantities of water in storage. However, fine grained materials impede the flow of water and consequently wells developed in such materials may not meet normal household requirements adequately. Coarse sediments such as coarse sands and gravel allow water to flow through easily and are usually good sources of water supply.

When a well is operating, the water level around the well is lowered in the form of a cone. This cone of depression may extend for many miles under some conditions where large amounts of water are pumped from the ground, or it may extend only small distances. The water levels in other wells within the area of interference will generally be lowered to some degree if the wells end in the same formations as the larger wells.

Before large withdrawals of groundwater are planned in any area, a reliable estimate should be made of the average perennial recharge of the aquifer. If this is done, the depletion of groundwater stored in aquifers can usually be avoided, and pumping installations can be designed for long, economical use.

WATER USE²

A small rural community with little or no industry has an average *per person* consumption of from 50 to 60 gallons of water daily. This will increase to around 100 gallons per day with moderate amounts of lawn watering and may exceed 200 gallons per day if considerable water is supplied to industry and commercial use.

Because of wider use of such appliances as automatic washers and garbage disposals, as well as the increasing attention to personal hygiene through bathing, the per capita use of water is rising. It is estimated that during the summer the average daily use per person of water is near 100 to 150 gallons. This may seem surprisingly high but the average citizen is not aware of just how much water is consumed for simple domestic use. The O.W.R.C. in 1968 calculated an approximate usage of water chart for the home which is fast becoming outdated:

tub bath	30-40 gallons
shower	20-30 gallons
laundering	20-30 gallons
rinsing	20-30 gallons
dishwashing	8-10 gallons
toilet	3-5 gallons

²Ontario Water Resources Commission - Water Resources and its Management; Background Dossier, 1969

REGIONAL AQUIFER CHARACTERISTICS OF WENTWORTH COUNTY

As has been suggested groundwater is an important aspect of the total environment of any area. Mining of the groundwater can cause surface streams and ponds to dry up. Valuable recharge areas can be destroyed by such things as pavement on highways, housing development schemes, etc. This in turn can have repercussions on vegetative cover and wildlife habitat. Therefore, for preservation and wise management of our water systems it is essential that we understand an area's hydrogeology.

Unfortunately, a complete hydrogeologic study has not been undertaken for the whole of Wentworth County. Thus, to gain a reasonable knowledge of the groundwater situation, I have attempted to review various studies and reports and interviews with individuals who deal either directly or indirectly with water problems.

The Ontario Water Resources Commission (O.W.R.C.) has a very brief summary of the groundwater conditions for the Southwestern area of Ontario.³ The report states: the area has "good" groundwater supplies in a majority of the counties. "Poor" water conditions, as a rule, occur where there are extensive deposits of impervious clays. A few communities that use large amounts of groundwater have had some difficulty in increasing their supplies. In most rural areas where shortages occur during times of drought the deepening of existing wells or the construction of new, deeper wells, can result in a more continuous supply of groundwater, but knowledge of local conditions is advised before deepening operations are carried out.

³ Ontario Water Resources Commission - Water Resources Bulletin 6, Southwestern Area, 1960-63.

For Wentworth County, the report states: the groundwater conditions in the counties of Wentworth, Brant, and Norfolk are generally good. The presence of sands and gravels in old deltas, kames, and river courses has given these counties an abundance of groundwater in many areas. For comparison, poor groundwater conditions are reported for the neighbouring counties of Haldimand, Welland and Lincoln.

Since O.W.R.C.'s report was based on information up to 1965 I contacted Mr. Leon Bryck, Supervisor of the Water and Well Management Branch of O.W.R.C. to try to gain information to update the study. He tended to agree with this report - generally the quantity of groundwater supplies within the county of Wentworth is adequate. A good part of the county well system receives their supplies from bedrock. The chief aquifer is a jointed dolomite - Amabel or Guelph formation which gives good yields. A number of the wells, especially the older dug ones are, however, in sand and gravel deposits. These also generally supply good domestic quantities. However, for large supplies such as industrial usage there is not much potential and here well users could run into some difficulty. Mr. Bryck mentioned one problem area - the Waterdown area which is experiencing difficulties in obtaining adequate supplies. This will be discussed in detail later.

Dr. P. F. Karrow has prepared a study of the bedrock topography of the Hamilton-Galt area.⁴ Part of his study area occurs within Wentworth County. The townships of Beverly, Ancaster, West and East Flamborough are briefly mentioned with respect to surface deposits and their groundwater capacity. The Halton till which locally covers some of the surface area has a relatively poor supply of groundwater.

⁴ Karrow, P.F., Pleistocene Geology of the Hamilton-Galt Area, Geologic Report No. 16, 1963.

The till is impermeable and there is a lack of stratified sand and gravel aquifers. Also in some areas the bedrock is shale which often yields only mineralized waters. Dr. Karrow found instances of buried valleys such as the Dundas Valley where thick gravel deposits are often good local sources of useable groundwater.

The Hamilton Region Conservation Authority undertook a study with respect to water conditions in the Spencer Creek drainage area in 1960.⁵ A brief section of this report deals with the groundwater situation and discusses the local aquifers. According to this study the groundwater supply picture is a mixed one. In Wentworth County the Queenston formation (shale) has poor groundwater possibilities. Water which the formation supplies is often highly mineralized with iron, sulphur or sodium chloride. Rocks of the Medina formation also usually supply highly mineralized water except along the Niagara escarpment where the supplies are often potable (suitable for drinking). Water from the Clinton formation is usually too mineralized to be potable. The Rochester formation of soft shale with thin limestone beds is unsuitable as an aquifer but because of its impervious nature, it tends to confine groundwater between it and the overlying dolomites. The contact between these formations is, therefore, a very good horizon. Many springs occur above the Rochester shales along the face of the Niagara Escarpment. Not many wells are reported ending in this formation but the indications are that if no water is obtained above the shales, a well penetrating them to any depth is inclined to be highly mineralized. In the Guelph and Lockport rocks (dolomite) the water supplies are usually good both as to quantity and quality, partly because of high rock porosity. Good water supplies may often be obtained at shallow depth. In Beverly Township and in the Flamboroughs,

⁵ Spencer Creek Conservation Report (Water section), 1960.

deeper wells run the risk of penetrating highly mineralized waters.

Generally speaking there does not seem to be a great water supply problem in the Spencer Creek Drainage area, although it is a fact that adequate supplies for some purposes may be difficult to obtain. The Conservation Authority's report suggests that continuation of urban expansion and increasing irrigation will undoubtedly increase the water supply problems. It also recommends a relatively low population density in the area north of No. 5 highway to keep demands on the quantity relatively low.

Groundwater and Well Hydraulics

Well data can also be applied to give a picture of the groundwater situation. By looking at water well records we can obtain basic statistical data on locations, numbers and specific uses of wells and by using calculated theories and equations we can estimate yields of the aquifers in specific locations. The well data was supplied by the O.W.R.C. in the form of the logs of waterwells which had been drilled in Wentworth County from 1964-1967.⁶

Well Statistics

In comparison with the surrounding counties Wentworth had a larger number of wells drilled in the period 1965-67 (see Table 1). However this can be accounted for by the population densities of the counties.

Haldimand and Wentworth both have a high percentage of wells in bedrock aquifers with approximately 80% of the wells ending in bedrock. Lincoln County is also high (73%) but for

⁶ O.W.R.C. Water Resources Bulletin 2-10, Southwestern Area, 1964-67.

comparison both Brant and Waterloo Counties have more wells in the overburden aquifers.

Within Wentworth itself, the township statistics are compared (see Table 2). The relationship between township population density and number of wells drilled is rather complex. Saltfleet township has a distinct high density but the lowest number of wells. Ancaster also has a high density but a somewhat lower number of wells. Presumably public services in these townships serve a wider area, and there is therefore less need for wells. Otherwise in comparing density and number of wells there is almost a direct relationship. As the number of people increases, so does the number of wells.

Table 1: Comparison of Wentworth County to Surrounding Counties 1965-1967

County	Total No. of Wells Drilled	Water Bearing Formation				Type of Water		
		Over-burden	Bed-rock	Not Indic.	Dry	Fresh	Salt or Sulphur	Mineral
Wentworth	1026	191	815	8	12	941	60	5
Waterloo	629	446	131	50	2	555	3	11
Brant	300	189	101	5	5	260	27	1
Haldimand	212	23	179	6	8	167	25	3
Lincoln	314	82	229	1	2	286	72	3

Table 2: Township Well Statistics

Township	Number of Wells Drilled					Comparison of Population Density/sq.mi.
	1964	1965	1966	1967	Totals	
Ancaster	30	34	30	52	146	219.5
Beverly	40	40	47	57	184	54.0
Binbrook	22	43	36	30	131	81.6
E. Flamborough	46	56	75	67	244	112.7
Glanford	56	65	42	43	206	121.8
Saltfleet	14	20	19	29	82	429.6
W. Flamborough	58	64	70	68	260	195.1
City of Hamilton	20	23	9	4	56	

Uses of Wells

Township	Dom.	Dom. Stock	Stock	Public	Comm.	Ind.	Irr.	Test Hole
Ancaster	98	21	6	5	2	-	1	11
Beverly	137	19	7	8	3	2	1	-
Binbrook	122	3	5	-	-	-	-	-
E. Flamborough	221	6	2	6	3	1	1	-
Glanford	91	6	3	3	1	-	1	-
Saltfleet	65	4	5	5	11	1	-	-
W. Flamborough	222	13	8	6	5	1	-	-
City of Hamilton	50	-	-	1	2	2	-	-

Domestic use was by far the predominant use of wells. The only noticeable statistic was the higher percentage of wells in Saltfleet used for commercial purposes (13% compared to less than 5% in the rest of the townships). This may have an effect on the groundwater system as generally commercial

use tends to draw larger amounts in a smaller area.

Additional Data

Additional statistics (not presented in the charts) were calculated. The number of dry wells reported for all the townships from 1964-1967. Surprisingly, only 2 dry wells were reported for Ancaster and East Flamborough.

West Flamborough had 5 and the other townships reported none. However, these are only at the time of digging and the actual number of dry wells may be quite a bit higher.

The quality of the water in the townships was also reported as very good. The only natural contamination which occurred was sulphur. The percentage of sulphur containing wells varied from a high of seven percent of the wells of Binbrook and Saltfleet Townships to a low of one percent of the wells in Ancaster. The City of Hamilton had, however, a somewhat higher percent of sulphur wells (15%).

Estimated Yields of Aquifers From Well Data

Well data can also be applied to calculate an estimate of the yield of the aquifers.⁷ Although a brief description of hydrogeologic theories and terms was given previously, additional explanations and definitions for this section are necessary and found in the Appendix.

Because the well data was arranged in townships, I have undertaken to do the analysis likewise. I have also included where possible, discussions of other reports and information gained through interviews with various individuals.

To help understand the groundwater situation the following was undertaken:

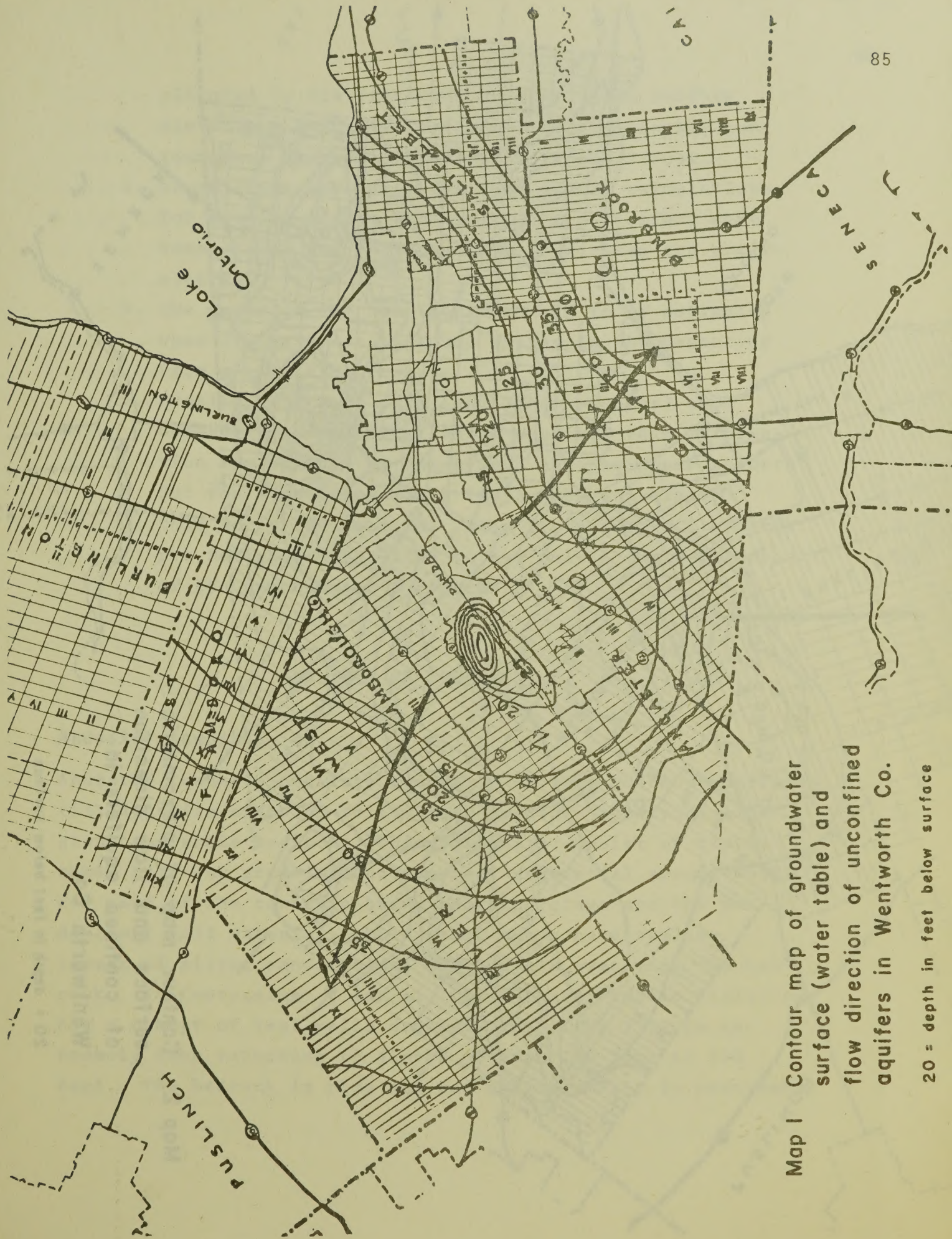
⁷ Todd, D.K. (1959) Groundwater Hydrology.

First, contour maps were drawn of the water table levels and the piezometric surfaces for Wentworth County. This would show roughly the patterns of the flow of the groundwater. The following maps present this data.

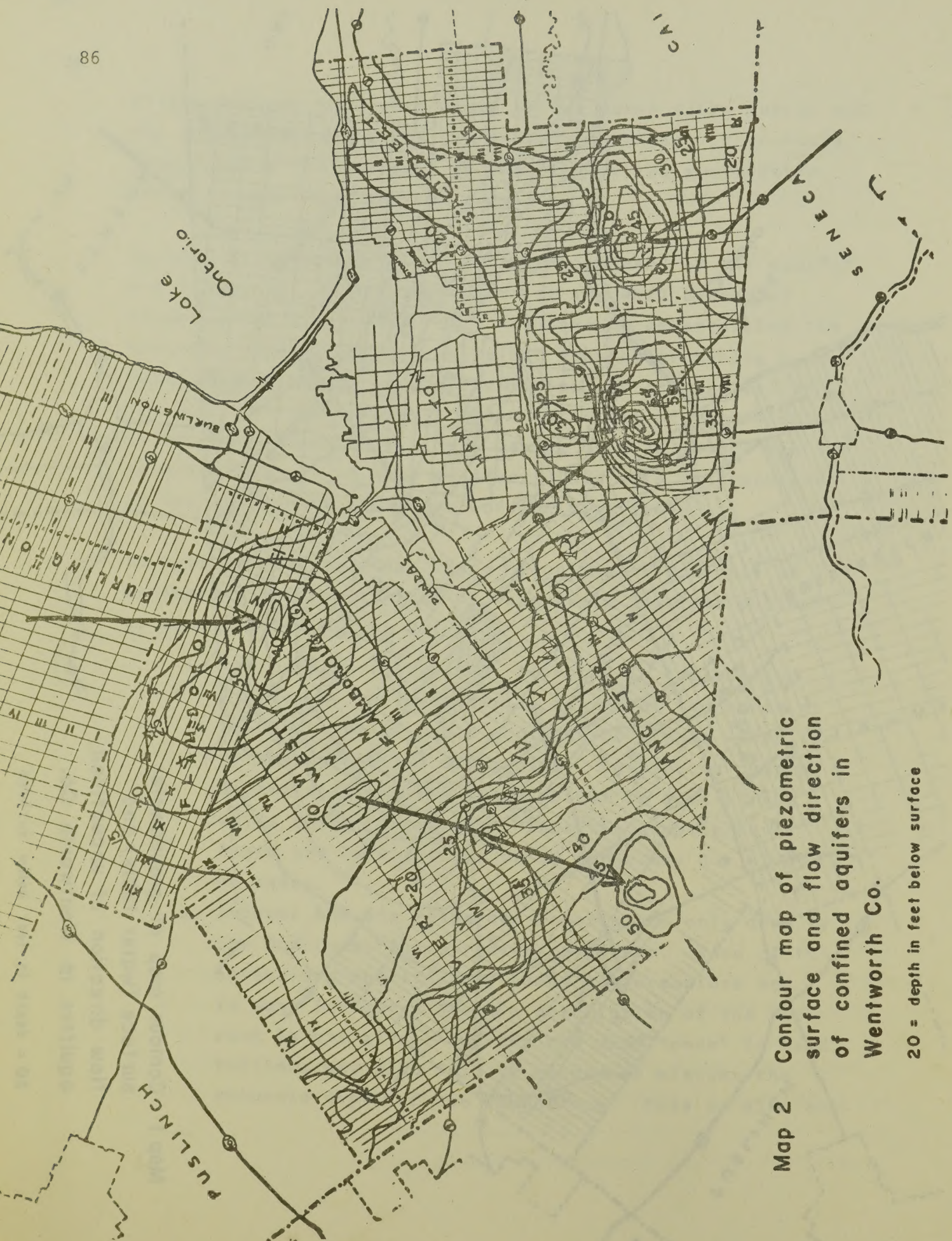
Second, an actual estimate of the "goodness" of the aquifer was calculated by using groundwater and well hydraulic theories and equations. This was done by ascertaining the specific capacity of the wells and then after making a reasonable estimate of the coefficient of storage (after the U.S. Geologic Survey), the coefficient of transmissibility was established. This can be used to assess the potential supply of each aquifer. This data is discussed in the section on townships and municipalities.

It must be realized that these calculations are only an estimate. Interpretations of water-well logs are subject to some uncertainties as:

1. the pumping-test rates, reported in gallons per minute, do not necessarily represent the rates at which the wells could continue to supply water for prolonged periods of pumping. Continuous pumping at the stated rates could result in some of the wells being pumped dry. Thus the pumping level depth and calculations based on it may not always be exact.
2. because the log notes and remarks are only done by the drillers, inaccuracies may occur. None of the strata are specifically named as formations and in many instances where a description of the bed-rock is not given - merely the word "rock" is used. Drillers may also fail to record or mistake the accurate depth of the formations. This is also com-



Map I Contour map of groundwater and surface (water table) and flow direction of unconfined aquifers in Wentworth Co.
20 = depth in feet below surface



Map 2 Contour map of piezometric surface and flow direction of confined aquifers in Wentworth Co.

20 = depth in feet below surface

plicated by the fact that in many cases surface elevations have been estimated by topographic contours and may be in error as much as 10 feet.

3. assumptions were made for some of the calculations. For example it was assumed that the aquifers were homogeneous and that the well penetrated the entire aquifer.
4. the depth of the same aquifers had to be estimated when it could not be found either in the report or from geologic sources.
5. finally, the well data (and other reports) were somewhat out-of-date. Where possible this information was updated by interviews and newspaper reports. But for much of the data (well data especially) this could not be done. Also since the well reports are for years 1964-1967 we see only a small picture of the groundwater situation.

ANALYSIS OF TOWNSHIPS

Ancaster Township

Ancaster township consists generally of very thick stratified till deposits often up to 150 feet in depth overlying limestone and shale bedrock. These deposits consist of clays, sand, silt and gravel in no apparent sequential arrangement. For part of the township brown and blue clays are the predominant till material, while other areas have shallow layers of silts, sandy loams, and gravels overlying the bedrock. In Concession , lot 41, the Ancaster Public Utilities had a number of test wells drilled. Here the till is extremely deep extending to depths of from 275 feet to 300 feet. The bedrock is blue and red shales. This is presumably

the buried Dundas valley referred to by Dr. Karrow's study. The two wells that had a pumping test rate reported were both deep - one in a silty red and grey clay layer at 284 feet, and the second in a gravel layer at 155 feet. The S.C. (specific capacity) were 5.4 and 8.3 respectively, thus the wells would be very good. The domestic wells however were not that deep. Where the limestone was fairly shallow (80-100 feet) some wells penetrated here. However, a great majority were just in the overburden. The shallow clays proved to be relatively poor aquifers with sand and gravels slightly better but still not too reliable. Deeper gravels and sandy layers were calculated as fair aquifers. Where wells were in the limestone bedrock, the aquifer was fair to good. This also applied to the shale bedrock. Thus the groundwater situation in Ancaster township appears rather poor. A detailed study is highly recommended.

Beverly Township

Beverly Township is also covered by a stratified till deposit. Limestone occurs at a somewhat shallower depth. Once again the shallow clay aquifers were poor, while gravel aquifers ranged from poor to good as the strata were at lower depths. The limestone aquifers generally were calculated as good to very good. The situation of the aquifers is not that good but will supply domestic yields.

Binbrook Township

Binbrook Township is covered for the most part with a brown or bluish clay extending to depths of 25 to 35 feet below the surface. The bedrock is either shale or limestone. Most wells end in the bedrock formation. The limestone aquifer appears as good to very good. Only 3 wells were reported ending in the shale layer. Both wells had high testing rates

but this will not give a reliable estimate of the aquifer and as more well statistics were not available, I did not wish to comment on the shale layer. The O.W.R.C. did a water pollution survey of Binbrook township in 1968.⁸ In this study some of the groundwater was tested. It was found that the older homes generally use dug wells for their source of water while the newer homes have drilled wells varying in depth from 30 to 120 feet. The groundwater was found to be characterized by being quite hard, high in iron and high in sulphates concomitant with excessive concentrations of sulphides in some areas. Because of the hardness and high iron content of the groundwater, rainwater from cisterns is often used for laundry and bathing.

There appeared to be no shortage of water for people on drilled wells (bedrock wells). There were also a number of industries which relied on drilled wells for their supplies and they also appeared to be adequate.

Thus aside from a few problems (not usually bad enough to prevent drinking) the bedrock aquifers appeared quite satisfactory. Dug wells in shallow overburdens are however, more frequently of bad quality (both chemically and bacteriologically) and are generally poorer sources of supply.

East and West Flamborough

In the eastern part of the townships especially in East Flamborough along Highway 5, a layer of clay approximately 20-30 feet deep overlies the limestone bedrock. This clay is relatively impervious, thus making the aquifer a poor one. Bad well situations should be expected to occur in this area. As one goes further west the surface cover be-

⁸ O.W.R.C. Township of Binbrook, Water Pollution Survey, 1968.

comes more varied; brown loams, gravels and sandy clays now begin to take the place of the clays. There are also instances of shale and shaly limestones overlying the limestone-dolomite layer. Most of the wells end in the limestone formation and the calculations show the aquifer here to be fair to good. There are a few reports of wells in the gravels which are found above the limestone (around a depth of 40 feet). These aquifers also yielded a reading of fair to good. Where the well is very deep in the limestone and there are no clay coverings the well yields become distinctly higher - thus the character of the overburden plays a most important role.

Generally the aquifers can only support small domestic supplies and the very eastern section of East Flamborough should not rely on groundwater to any great extent.

Glanford Township

Here the limestone bedrock is slightly deeper - around 75 to 85 feet in depth. The overburden cover once again varies from sand to clay. Where clay is the only covering or is the layer next to the bedrock, the same situation prevails - that is the aquifer yields are fairly poor. Where there are thick gravel deposits, the overburden wells yield good domestic supplies, but this situation is rare. Most of the wells terminate in the limestone formation.

From a study done by the O.W.R.C. on the village of Mount Hope located in the centre of the township, the following information was obtained concerning the groundwater.⁹

The capacities (of the groundwater supply) vary from property

⁹ O.W.R.C., Water Pollution Survey, Hamlet of Mount Hope, 1968.

to property - some have adequate amounts for domestic use, others do not. It was reported that in some cases there is not enough water to provide for laundering, bathing or even regular flushing of toilets. A number of residents supplement their supplies with rain water from cisterns or have water hauled in. Of the 168 residents contacted *during this survey, one half indicated that they experienced shortages* of water during the summer months; the remainder stated that they had adequate amounts for household uses, but were cautious with its use on gardens and lawns.

For qualitative analysis of the water, 110 well samples were collected. The bacteriological results were: 16.5% of the wells showed contamination, the majority of the results showed densities of less than 50 coliforms per 100 ml. (above Commissions standard). It is not conclusive from this survey that the groundwater is necessarily polluted, as it is possible that contamination results from faulty well seals or pumping equipment.

The chemical analysis showed the groundwater in the area is hard, in some cases high in iron, and about 50% of the wells are reported to impart sulphurous taste and odour. Because of this a number of residents obtain water for drinking and cooking purposes.

In conclusion, the village of Mount Hope appears to suffer from a shortage of water. This in conjunction with unsuitable chemical and bacteriological quality in a number of cases indicates that groundwater supplies are not that reliable.

Although situations in the rest of the Township are not

similar to Mount Hope (i.e. - less population density and contamination from septic tanks), nevertheless great care should be taken when dealing with groundwater supplies here.

Saltfleet

Saltfleet, also, has a cover of clay overlying the limestone bedrock. The clay cover is about 15 to 25 feet deep. There are very few wells reported that do not terminate in the limestone and most well yields are adequate. However, because the aquifer is overlain by clay, it is only fair, and large groundwater supplies could not be expected. The situation here can only support small domestic supplies.

MUNICIPAL WATER SOURCES

Groundwater supply systems are for the most part located in rural areas. In Wentworth County, the larger urban areas are very fortunate in that they do not have to draw their water from the ground but receive their supplies from Lake Ontario. To get an understanding of the total water supply, it is necessary therefore, to look at the various municipalities sources and ascertain if there may be any problem which could arise here.

Hamilton

Hamilton receives its water from Lake Ontario from two intake pipes which are located 2500 feet out from the shore. In 1970 the average consumption was 70,753 million gallons per day. The water is treated at the purification plant by chlorination, ammoniation and fluoridation. Hamilton has 548.6 miles of 4" by 48" watermains and all but an area south of Limeridge Road on the mountain is serviced. There

are 5 storage reservoirs (four underground, one above) with a combined capacity of approximately 90 million gallons. There are four low lift pumps, fifty high lift pumps and four booster stations. The present capacity of the total system is 80,000 million gallons per day.

In an interview with Mr. Sharman of the City Water Works Department it was learned that there are plans to increase the capacity of the system within the next few years. The plans for expansion are based on population growth projections from an engineering level. These are based primarily on past growth curves with a percentage increase to update it. The present plans encompass the next fifteen years.

The payment for water services in Hamilton is a somewhat different system than surrounding municipalities. All households pay a *flat annual rate* based on the assessment used to calculate the taxes on lands and buildings except under the following conditions:

1. if the watermain connecting their household to the system is greater than $\frac{1}{2}$ inch
2. if there is any water-using product, cooling equipment, garbage-disposal unit, or air-conditioning equipment used in the household
3. or if there is a pool having a capacity of more than 500 gallons.

Under these circumstances the householder must pay a metered rate. This rate is calculated in two parts - a minimum charge for the first 10,000 gallons of water, according to the size of the waterpipe and a gallonage rate over and above the first 10,000 gallons.

All other uses other than domestic are charged meter rates.

Burlington

Burlington also receives its water from Lake Ontario. The total water consumption in 1970 was 2,599,690 million gallons. This served a population of 76,000. Thus the average per day use was approximately 7.12 million gallons. The present capacity of the system is 31 million gallons per day. Burlington has five reservoirs with a combined storage capacity of 7 million gallons and five booster stations. There are approximately 200 miles of watermains and about 16,874 service connections.

Burlington citizens pay for their water by a metered rate. There is a basic charge and then an additional charge for amounts above the original gallonage.

Stoney Creek

Stoney creek purchases water from Hamilton. The Stoney Creek system is connected directly to the Hamilton system and a metered device measures how much water is pumped through. The average consumption is 555,000 gallons per day. This serves a population of 7,400. Stoney Creek citizens pay for their water service on a metered basis.

Dundas

Dundas purchases water from the Hamilton system. They are supplied an approximate average of 1 million gallons per day and this serves their population of 15,178 (1969). There are at present four pumping stations and two storage reservoirs with a combined capacity of 1,750,000 gallons. Dundas anticipates the installation of another reservoir on York Road in 1972. This should make their services more than adequate. Dundas services are also metered. The basic rate is 800 cubic feet for 2 months. There is a higher levy for

additional amounts of water.

Ancaster

The community of Ancaster is supplied with water by a system of 7 wells. The system has an average output of 400,000 gallons per day and presently serves about 10,000 people. The services are located within the village proper and have been extended to take in the area developed of Spring Valley. Mr. Wilson of the Public Utilities Commission indicated that the present well supply is adequate to serve 18,000 people, and distribution service is adequate for a population of 35,000. An alternate water supply would be needed for 25,000 people but it is felt this population level would not be reached for 15 to 20 years.

At present, the Ancaster P.U.C. is planning well exploration in the fall (1971) in the Sulphur Springs area.

Saltfleet

The township of Saltfleet purchases water from the City of Hamilton and the Town of Grimsby. The existing distribution system is contained within the area north of the Escarpment. E. D. Smith Ltd. has a private supply system pumping directly from Lake Ontario and also a reservoir on the Escarpment south of their plant. There is also a small diameter private system on Lakeview Drive servicing a number of residential properties.

The Hamilton supply in 1969 provided water for a population of 12,180 and the Grimsby supply provided water to 1,880 people. The average daily consumption for each was 68 gallons per capita and 65 gallons per capita respectively. At present there are two reservoirs (one each for each supply) and

one booster pumping station located at Barton Street.

In a study done by Damas & Smith for the township of Saltfleet Planning Department in 1969,¹⁰ two deficiencies in the system were reported. These were:

1. insufficient storage capacity to maintain the supply during prolonged periods of failure in the main feeders.
2. inadequate pressure during times of peak water consumption at the foot of the escarpment.

Several suggestions were made to overcome these deficiencies. At present the following is being done:

1. a new reservoir is being constructed next year and this will increase the capacity of storage to approximately 30 million gallons
2. the construction of a new 48" feeder main has begun. This will connect the Hamilton system and the western Township limits. This main will have sufficient capacity to meet the township needs for many years. New mains are also planned to improve supply to the industrial area and to eventually increase pressures in the north-easterly part of the township.
3. small booster stations are being constructed in the areas below the escarpment.

Once these additions have been completed the water service should be adequate for several years.

Waterdown

As mentioned before, Waterdown has become a problem area. At present the village is supplied by eight wells.¹¹ Seven have relatively limited capacities ranging from 10-35 gallons per minute. The eighth, the Wellington Street well has a

¹⁰ Damas and Smith, Water Study, Saltfleet Township, 1969.

¹¹ Water Works Report, Village of Waterdown Public Utilities Commission Report, 1970 (March).

rate of 110 gallons per minute. The water is hard and somewhat high in iron content but otherwise acceptable. The total capacity of the wells is 250 gallons per minute or 360,000 gallons per day. The distribution system is generally a well-connected network.

The report stated that although the supply was adequate for present demands, during peak demand periods and during the hot dry summer months, severe shortages would be created in the future. It recommended that an additional well be considered or an alternate supply of water be looked into. This was heightened by the fact that certain areas in Waterdown had been designated as high density development areas and the population could conceivably increase from 2,150 to 5,400 in a very short time. A supply capable of serving 5,000 people initially, with consideration given to eventually serving a total population of 10,000, was recommended.

Test wells had been carried out in the area since 1958 and are not at all encouraging. Thus the alternative of obtaining water from the Burlington system was suggested.

Other problems which were incurred in the study were the storage tanks. The elevated tanks showed signs of deterioration and leaks were present in the bottom. It was recommended that construction begin on a new 5,000,000 gallon elevated tank.

The recommendations were for the most part ignored and this summer (1971) the Waterdown system was operating at capacity. The Wellington Street well output had fallen to 42 gallons per minute and strict regulations were being put on the water usage. There were also complaints about dirty water. The village's water supply was stated as being in serious trouble

by the O.W.R.C. It was recommended that Waterdown immediately negotiate with Burlington for a pipeline which would supply the village with a water supply from their system.

To add to the problem, development was already approved for several apartment buildings which would require 75,000 additional gallons per day.

The Reeve of Waterdown was reported as saying "the situation is a lot more serious than we previously thought. There cannot be any more delays in getting water."¹²

But, unfortunately, negotiations with Burlington were being held up because the village residents felt that a plebiscite was needed to determine if the purchase of 500,000 gallons daily of fluoridated water from Burlington would be acceptable.

As of the end of August no further action on the problem was seen.

EXISTING CONTROLS OF THE GROUNDWATER

At present there exist certain controls which help to maintain efficient management of the groundwater system.

The Ontario Water Resources Commission is the prime regulatory body over all water systems in the province. As such they have regulations and requirements for the management.¹³

Firstly, the O.W.R.C. requires every well-driller to obtain

¹² *The Hamilton Spectator*, August 4, 1971.

¹³ Ontario Water Resources Commission Act, Revised Statutes of Ontario, 1960.

a licence before he can undertake operations. The Commission can refuse to issue a licence or can cancel or suspend it at any time. Thus, they effectively control *who* drills the wells. The drillers must submit a written report after each well they complete. This must include a pump testing rate of the well as well as a log of the strata through which the well passes. These records are prepared regionally into bulletins which are available to the public.

O.W.R.C. can also control the location, spacing, type of boring, and drilling of water-wells. They may prohibit or suggest materials used in well construction, pumps and other equipment. They may designate the use to which the wells are put, the abandonment of wells and the cleansing and disinfection. If the commission feels there is a specific area where wells must not be drilled they may issue a system whereby no individual may dig, bore, or drill a hole for obtaining water without obtaining a permit.

The Commission also has to a certain degree a control over the size of wells drilled. Anyone wishing to construct a well over 10,000 gallons (since 1961) must apply to O.W.R.C. for a permit. The application is put to a board which decides what effect the well will have on the surrounding area. If it doesn't appear that the well will hamper present flow, the permit is issued. The O.W.R.C. may offer alternate sources if the well is not suitable.

It is now required by law that all new public division housing schemes have a communal water supply. If this involves one large well, it must be tested before it can be approved. The well is drilled and pumped for a number of hours, then other wells in the area are monitored. If it appears that the other wells will not be affected, the well

will be approved, otherwise building cannot commence.

Thus it appears as if there is effective control over the construction of wells.

Qualitative Control

The quality control measures over the well system and groundwater are for a large part dealt with by the Ontario Department of Health. If a homeowner feels that his well is contaminated, he may ask the Department of Health to test it. They will then advise the owner whether his water is suitable for drinking. This service is only for individuals. Large scale pollution of groundwater such as oil spills are controlled by O.W.R.C. and are dealt with through them.

One recurring problem in well contamination in the rural areas is private septic tanks. Although the construction of the septic tanks is strictly supervised by the Department of Health, after they are operating there are no annual checks to determine if they are polluting the groundwater and well supplies.

Generally, no efficient control is exercised locally by townships or municipalities for private wells. Only municipal supplies if drawn from wells are controlled by O.W.R.C. and Department of Health standards.

RECOMMENDATIONS

After studying the groundwater situation, well data and existing controls over these, I felt there were some measures which could be taken which would facilitate management of the groundwater.

1. The "powers" which the O.W.R.C. have are excellent in some respects but since they have only been in effect for a few years a complete survey of older wells must be taken. Residents should be contacted and the quality and quantity of their wells investigated. This survey should be maintained - that is, an annual check should be performed on all wells.
2. There should be some local authority (perhaps a local branch of the O.W.R.C. within township or municipal settings) to whom residents should *have* to report well failures, shortages etc., and also quality disturbances.
3. If there is a known pollutant of groundwater, either by an individual's septic tank or some industry, the O.W.R.C. should use its powers to have the source cleaned up. Fines should be levied where possible.
4. An education program should be undertaken so that all people (not only well-users) realize the *value* of groundwater. Wastage and pollution of *all* water systems should be discouraged and the individual should be shown how he can contribute to better his environment by having respect for all the water around him.

GROUNDWATER HYDROLOGY

Water enters a reservoir from natural or artificial recharge; it flows out under the action of gravity or is extracted by wells. Ordinarily the annual volume of water removed or replaced represents only a small fraction of the total storage capacity. Aquifers may be classed as unconfined or confined depending upon the presence or absence of a water table.

An unconfined aquifer is one in which a water table varies in undulating form and in slope, depending upon areas of recharge and discharge pumpage from wells and permeability. Rises and falls in the water table correspond to changes in the volume of water in storage within an aquifer. Figure 1 below shows an idealized section through an unconfined aquifer. Figure 2 is a diagram of both unconfined and confined aquifers.

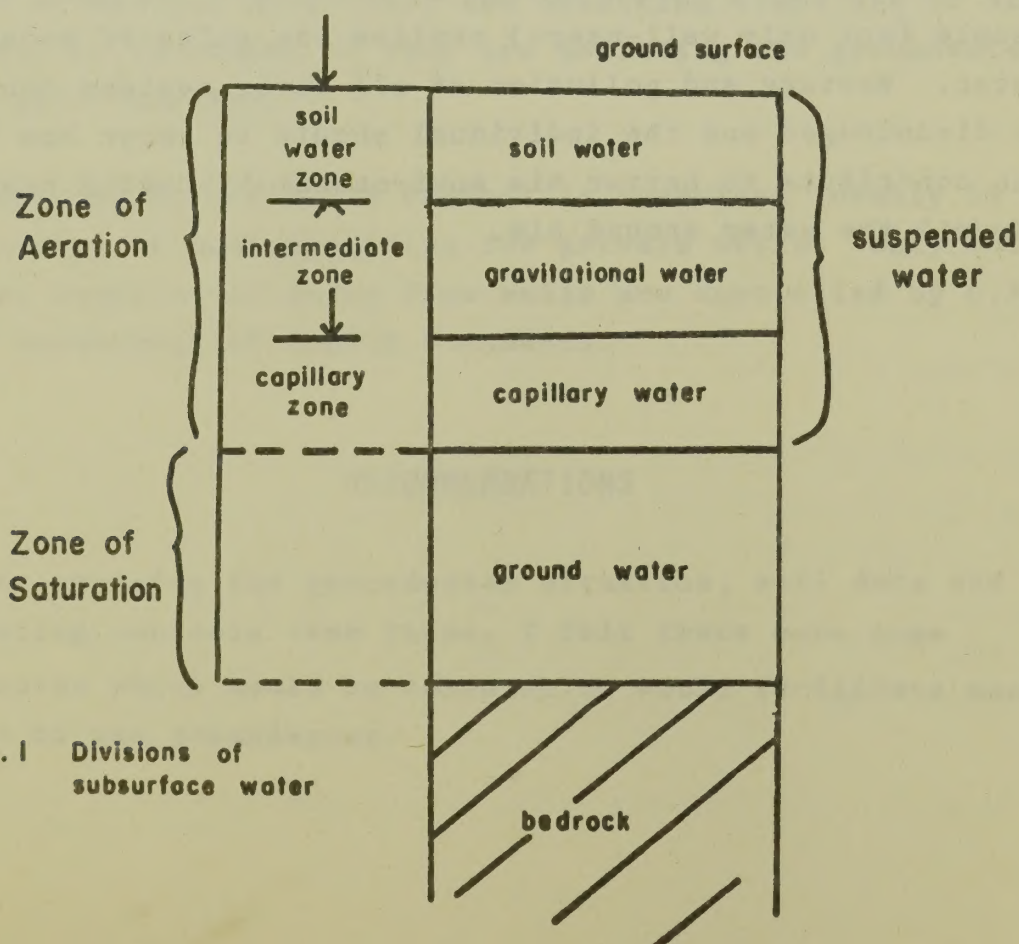


Fig. 1 Divisions of subsurface water

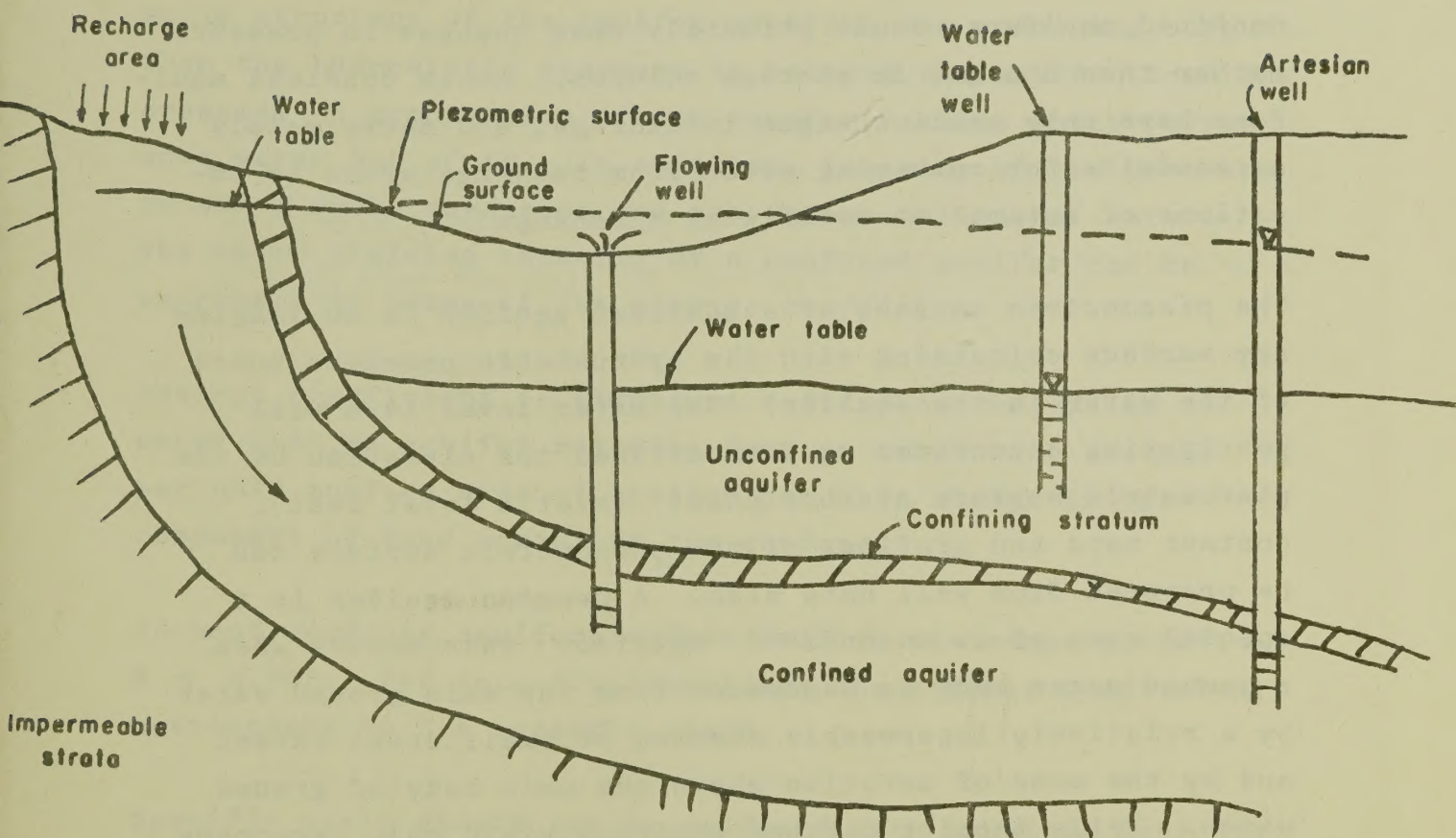


Fig. 2 Unconfined and confined aquifers

Contour maps and profiles of the water table can be prepared from elevations of water in wells tapping the aquifer to determine the quantities of water available, its distribution and movement.

Confined aquifers, also known as artesian or pressure aquifers, occur where ground water is confined under pressure greater than atmospheric by overlying, relatively impermeable strata. In a well penetrating such an aquifer, the water level will rise above the bottom of the confining beds. A region supplying water to a confined aquifer is known as a recharge area. Rises and falls of water in wells penetrating

confined aquifers result primarily from changes in pressure rather than changes in storage volumes. Hence confined aquifers have only small changes in storage, and serve mainly as conduits for conveying water from recharge areas to locations of natural or artificial discharge.

The *piezometric* surface of a confined aquifer is an imaginary surface coinciding with the hydrostatic pressure level of the water in the aquifer. The water level in a well penetrating a confined aquifer defines the elevation of the piezometric surface at that point (static level feet). Contour maps and profiles of the piezometric surface can be prepared from well data also. A *perched* aquifer is a special case of an unconfined aquifer. This occurs when a ground water body is separated from the main ground water by a relatively impermeable stratum of small areal extent and by the zone of aeration above the main body of ground water. Wells tapping perched aquifers yield only temporary or small quantities of water.

Water recharged to or discharged from an aquifer represents a change in the storage volume within the aquifer. The specific yield is a fraction of the porosity of an aquifer, and values depend upon grain size, shape and distribution of pores, and compaction of the strata. For uniform sand, specific yield may equal up to 30%, but most alluvial aquifers give values in the range of 10-20%. For *confined aquifers*, however, assuming the aquifer remains saturated, changes in pressure produce only small changes in storage volume. Thus the hydrostatic pressure within an aquifer partially supports the weight of the overburden while the

solid structure of the aquifer provides the remaining support. When the hydrostatic pressure is reduced the aquifer load increases. A compression of the aquifer results which forces some water out of it. In addition, lowering of the pressure causes a small expansion and subsequent release of water. The water yielding capacity of a confined aquifer can be expressed in terms of its *storage coefficient*.

Storage coefficient is therefore defined as the volume of water that an aquifer releases from or takes into storage per unit surface area of aquifer per unit change in the component of lead normal to the surface.

In most confined aquifers values fall in the range $0.00005 \leq S \leq 0.005$. For unconfined aquifers the storage coefficient corresponds to its specific yield.

Specific yield should not be confused with *specific capacity*.

Specific capacity of a well is a measure of the effectiveness of the well. It can be found by dividing the discharge by the draw-down of the well. From our well data we found this by the formula:

$$SC = \frac{\text{pumping test rate in g.p.m.}}{\text{difference between pumping level feet and static level feet.}}$$

For our purposes it was calculated that values of S.C. had the following classifications:

>2.0	-	very good
2.0-0.5	-	good
0.49-0.10	-	fair
<0.10	-	poor

Another important factor in well hydraulics is the permeability of the aquifer. This is a measure of the ease of flow through a media. The coefficient of permeability (K) is defined as the flow of water at 60 degrees F. in gallons per day through a medium having a cross-sectional area of 1 foot² under a hydraulic gradient of 1 ft./1 ft.

Since we could find the coefficient of transmissibility, therefore we could estimate the coefficient of permeability and fit the aquifer in its proper category on the defining chart.

ACKNOWLEDGEMENTS

I wish to thank Mr. Kevin Lethbridge, Mr. Tony Yakutchik and Mr. Leon Bryck of the Ontario Water Resources Commission, Toronto, for their help in securing data and their many useful suggestions and information.

I also would like to thank Mr. Julian Coward, of the Geology Department of McMaster University, for his many suggestions and assistance with the groundwater theories and well hydraulics.

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CHAPTER FOUR

SEWAGE TREATMENT

marnie fogwell

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INTRODUCTION

The ultimate goal for sewage treatment is that water be returned to its source in the same condition that it originated. We expect the water we use to be safe, and clean enough for drinking, which is the highest quality we demand from our water. Yet for years man has proceeded carelessly, grossly mismanaging his water resources and expecting "nature" to make everything all right. Unfortunately with the world's growing population "nature" is seldom able to correct the mistakes that man has made. Water is all around us. There is so much that it doesn't seem possible to pollute it, to render it unfit for *any* type of life, let alone the high criteria we demand of water meant for human consumption.

Discharge of untreated sanitary and industrial wastes to any body of water travels from creek to stream to bay to lake, and renders that body of water unusable for practically all purposes, particularly in the immediate discharge area. It makes the water offensive to man by its odor, appearance, and, as if this were not serious enough, it makes the water a menace to health. It upsets the cycle of plant and animal life through decrease of the water's oxygen content, thus rendering it uninhabitable for fish.

To prevent this from happening there are sewage treatment plants for the treatment of sanitary (domestic) wastes, and means for treating most industrial wastes. Pollution of water bodies could be prevented by eliminating all waste discharges. However, efficient treatment of water can produce a satisfactory effluent for discharge.

Hand in hand with adequate sewage treatment goes an efficient sewer system. A separate one in which storm water (from precipitation) and sanitary waste (from homes, factories, etc.) are never combined is the best.

In a combined system storm water and sanitary sewage are mixed. Although cheaper than separate sewers, in times of heavy run-off the untreated sewage can often enter the receiving body of water directly through a storm outfall. (This occurs in Hamilton six to seven times a year.¹) In times of low run-off, the storm water which is combined with the sanitary sewage is transported to the treatment plant. Because the plants are designed to function most efficiently with sanitary sewage only, the added storm water decreases their efficiency.

The goal of this report is to state the ideal treatment of waste water as compared to its existing treatment within the study area.

METHODS OF SEWAGE TREATMENT

Primary Treatment

Primary treatment removes solids, floating scum and grease

¹ Personal communication - Mr. L. Sharman, City of Hamilton Engineering Department.

from sewage water. This treatment is used alone (or should be) *only* when its effluent will meet the water quality requirements of the receiving body.

Wastewater flows into the primary treatment plant through influent channels located under the influent building. It then passes through screens and shredders to prevent the entry of large objects which may damage equipment. The shredders cut the large objects to a size suitable for handling in the treatment phases to follow.

From the shredder the influent goes to a Collector Well. It is then pumped to grit-removal facilities, located on the roof of the building. The Grit Removal Facilities receive and delay the flow long enough to allow the heavier particles of grit and sand to settle to the bottom of the tanks for removal. Periodically the settled grit and sand is removed and taken to a disposal area.

Removal of organic material takes place in settling tanks. The velocity of the flow is reduced and heavier organic matter settles out. It takes up to two hours for the water to pass through these tanks during which 40 to 60 percent of the solids are removed.

The settled material or "raw sludge" is drawn from the bottom of the tanks and delivered to Digesters for further treatment. Surface scum is removed by a skimming mechanism and also delivered to the Digesters.

The partially treated wastewater or "primary effluent" is then chlorinated and released to the receiving body. If secondary treatment is to occur, the wastewater is released unchlorinated into a collector channel to be further processed.

Since May 1971, (according to Ontario Water Resources Commission Regulations) the final effluent must be chlorinated by 5 p.p.m. chlorine gas before being released to the receiving body of water.

Secondary Treatment - Activated Sludge

The activated sludge process is a method of complete biological treatment which in theory produces a high quality effluent but often doesn't. This is a secondary process, usually carried out following primary treatment. It removes the finely divided suspended solids and part of the dissolved materials remaining in the wastewater.

Biological communities of micro-organisms are developed and maintained in aeration tanks. A plentiful supply of oxygen is delivered to the micro-organisms by compressed air or mechanical agitators within the tanks. This permits the colloidal organic material in the wastewater to be oxidized by aerobic bacteria. The air of agitation produces a roll in the tank and prevents the settling of solids. As the bacteria assimilates the organic matter, a light sludge "floc" or "activated sludge" is formed. This sludge floc is the vehicle upon which the bacteria grow. It provides the means for maintaining the process.

Final settling tanks provide the means for removing and reclaiming the sludge floc. The wastewater is retained about three hours to allow the floc to settle. It is then removed and pumped back into the aeration section to be mixed with the primary effluent. This "seeds" the primary effluent and maintains the bacteriological process. Any unwanted sludge is transferred to the digesters. Generally, after this treatment 90 to 95 percent of the solids contained in the raw sewage are removed.

After chlorination the effluent is released to the receiving body.

Digestion

Digestion is the decomposition by anaerobic bacteria of settled solids or sludge removed from the wastewater. The raw sludge is pumped to the digesters where it is broken down by anaerobic bacterial action at a regulated temperature of from 90 to 95 degrees Fahrenheit. When it is thoroughly digested, it is a thick, black, odorless liquid which can be used as a soil conditioner. During digestion, methane gas is produced which is collected in the top of the digesters. The gas is used as a fuel for the plant boilers to heat the building and maintain the constant temperature within the digesters. Any excess gas is burned off. In the two stage digestion the primary digester constantly agitates the sludge while in the secondary one, the process continues in a quiescent state.

Sludge Disposal

After digestion all that remains of the raw sludge is methane gas and water, carbon dioxide, trace gases, residual organic matter and inorganic matter. Sludge can be used as a soil conditioner. It helps break up the earth and allows the soil to breathe. It can be used as a fertilizer, as in Milorganite, a fertilizer produced from the digested sludge from the Milwaukee Sewage Treatment Plant. However, modern digestion treats sludge so effectively that it is practically devoid of nutrients. Consequently, so much has to be added to make the sludge an effective fertilizer that it is cheaper to make fertilizer from synthetic materials. There are two prime reasons for this. The cost of hauling the vast amounts of digested sludge to the fertilizer plant

is prohibitive. Further, considerably more sludge fertilizer, in terms of volume, is necessary than synthetic fertilizer with the same nutritive value.

Some plants allow the local populace to take the sludge directly from the digesters to use it as a soil conditioner. This is not approved by the Medical Officers of Health, especially for crops meant for human consumption. A fear of pathogenic bacteria remains. Some municipalities bury the digested sludge and some incinerate it after dewatering the sludge. Incineration can be done less expensively than trucking the sludge to a site for land fill, but it may have associated air pollution problems.

Extended Aeration

The extended aeration process is another method of biological treatment that produces a high quality effluent. This process is identical to the activated sludge process, but there is no primary treatment and the solids contained in the influent are oxidized during the extended aeration period. Properly functioning this process is known as "total oxidation".

Biological communities of aerobic bacteria are developed and maintained in the aeration tanks where they are supplied with an abundance of oxygen. The roll in the tank produced by the compressors or agitation prevents the solids from settling.

As the organic impurities are assimilated by the microorganisms, the resulting sludge floc is readily settled. The floc is continuously recycled as the bacteria grow on it and maintain the process.

Final settling tanks remove and retain the sludge floc. The small amount of inert and oxidized matter remains, sometimes in the form of a white ash, and is periodically removed for final disposal. 90 to 95% of the solids are removed from the effluent.

Tertiary Treatment

Secondary treatment plant discharges can create undesirable conditions in receiving bodies of water. These discharges can bring about excess growth of algae and other aquatic plants due to high levels of nitrogen and phosphorus released into the receiving bodies.

To alleviate this problem, tertiary treatment is being developed as a third or "polishing" stage to follow conventional secondary treatment processes to reduce the organic content. This will improve receiving water conditions as far as the dissolved oxygen levels are concerned. Further, nutrient levels will be reduced (the nutrients which algae utilize for growth).

Experiments are being conducted at Canada Centre for Inland Waters and the Elizabeth Gardens and Drury Lane Sewage Treatment Plants in Burlington on phosphate removal from sewage. Tests are still in the preliminary phase.

One drawback in nutrient removal as a phase of tertiary treatment is that following secondary treatment the effluent only contains 5 to 8% nutrients. Water running off lawns and picking up fertilizers, flowing along asphalt driveways, contains about the same degree of nutrients. For phosphate removal as an aspect of tertiary treatment, perhaps we should treat the waters from storm sewers, but such

EFFICIENCIES OF SEWAGE TREATMENT METHODS

TYPE OF TREATMENT	PER CENT REDUCTION		
	suspended matter	B.O.D.	bacteria
Fine screens	5 - 20		10 - 20
Plain sedimentation	35 - 65	25 - 40	50 - 60
Chemical precipitation	75 - 90	60 - 85	70 - 90
Low rate trickling filter, including presedimenta- tion & final desimentation	70 - 90+	75 - 90	90+
High rate trickling filter	70 - 90	65 - 95	70 - 95
Conventional activated sludge	80 - 95	80 - 95	90 - 95+
High rate activated sludge	70 - 90	70 - 95	80 - 95
Contact aeration	80 - 95	80 - 95	90 - 95+
Intermittent sand filtration	90 - 95	85 - 95	95+
Chlorination:			
settled sewage		*	80 - 95
biologically treated sewage		*	98 - 99

*

reduction dependent on dosage

From: Ernest W. Steel, *Water supply and sewage* (New York: McGraw-Hill, 1960).

a procedure would be expensive.

ACTUAL TREATMENTS

Now that the ideal treatments for wastes have been presented, the existing treatments within the study area will follow for comparison.

Our main focus is Burlington Bay - the recipient of all the wastes we dump into it directly or into the streams feeding the Bay. The extreme pollution of the Bay which is contributed by all the municipalities surrounding it is a classic example of what can be done to the natural resources in the name of expediency. The "cleaning up" of the Bay must be a sincere co-operative effort by all the municipalities surrounding it.

Hamilton

Prior to 1955 all of Hamilton existed on a combined sewer system. Since 1955 all new sewers have been constructed on the basis of a separate system with sanitary drainage being taken from plumbing fixtures and cellar drains and storm drainage being taken from roadways, ditches, building lots and roof drains.

However, today most of Hamilton still exists on a combined system. Moreover, even as new separate systems are built, often they eventually dump into a combined sewer.

It has been estimated that at present day prices it would cost \$300 million to put the city on a separate system. While the separate system is desirable, when City Council seems unable to raise the money for a new secondary treat-

ment plant on its own, it is doubtful that something as prosaic as a combined sewage system would receive the necessary funding. As it stands there are six to seven spills of untreated wastes directly into the Bay every year due to the combined system.²

Since 1959, five trunk sewers have been proposed (Red Hill Creek Sanitary Sewer, Eastern Tributary Trunk Sanitary Sewer, Western Interceptor, West Hamilton Trunk Sanitary Sewer and the North End Urban Renewal Trunk Sanitary Sewer). The City is also reconstructing the existing combined sewer system in the North End Urban Renewal Area and the central business district. Connections are underway to join existing combined sewers to the new trunk sanitary sewers. This sounds progressive but means a dilution of the influent at the sewage treatment plant which decreases the efficiency of the plant's operation.

Hamilton's primary sewage treatment plant began operation in 1963. Its initial cost was ten million dollars and it was designed to handle a flow of 60 million gallons per day (m.g.d.). Presently the plant is handling 50 m.g.d., servicing 300,000 people. The operational cost is 4¢ per thousand gallons and the combined cost is 7.8¢ per thousand gallons. Secondary treatment adds roughly 40 percent to the annual cost. The secondary treatment plant should be in operation in early 1972 at a cost of around 22 million dollars. It is referred to as a companion secondary as its capacity is 60 m.g.d. to complement the primary plant. The primary plant is designed to remove 50% of the solids from the influent. According to the statistics from the 1970 Report done by the Municipal Laboratories, the primary plant is removing 23% of the total solids and 73% of the sus-

²Personal communication by interview from Mr. Les Sharman.

pending solids.³

Hamilton was put in a rather unique position by the new treatment plant. The City, when asking for bids in 1969, anticipated tenders of around \$17 million. The lowest tender came in about \$4 million over this figure. Board of Control and City Council couldn't see their way clear to allocate the extra funds necessary for the project. At one point it seemed that the whole project would be shelved but the Ontario Water Resources Commission stepped in stating that Hamilton must install the plant.

The O.W.R.C. essentially has the authority to go ahead and provide and install the necessary equipment if the municipality does not comply with their regulations. After the installation is complete, the O.W.R.C. bills the municipality for the work done. The O.W.R.C. has taken over the financing of the new secondary treatment plant for a forty year period. This is the largest single project the O.W.R.C. has ever financed. It is different from other O.W.R.C. financed operations in another way as well. Normally when the O.W.R.C. takes over a project, they continue to operate the plant after its completion. However, after much consultation, it was decided that the City of Hamilton will run the plant. This summer (1971) there have been many disputes by private contractors about payment by the O.W.R.C. for work on the project. The court cases are still proceeding at the time of writing.

The third phase of Hamilton's plan for the treatment of sewage wastes calls for the construction of a duplicate primary treatment plant with a capacity of 60 m.g.d. This

³ Communications from D. H. Matheson, Les Sharman and Wm. Phillips.

is proposed for the five year capital budget. The fourth phase calls for the construction of a companion secondary treatment plant for the duplicate primary treatment plant, also designed for 60 m.g.d. This will increase the capacity of the overall plant to 120 m.g.d. - capable of serving 600,000 people. At present, Stoney Creek and Saltfleet Township are connected to the Hamilton sewerage system and discussions with Glanford Township, to include it as well, have been undertaken.

The digested sludge from the Hamilton Treatment Plant is to be incinerated. It makes good clean land fill but the cost to transport it is very high (and the City is responsible for the cost of transport, not the contractor utilizing the fill). The digested sludge is not a good fertilizer because after treatment it is low in nitrogen and phosphorous. It needs to be fortified and is therefore too expensive. While it does make an excellent soil conditioner, for aesthetic reasons people don't want it and for health reasons the Medical Officer of Health will not allow it to be used on farm land.

In 1966 the City passed Bylaw 66-75 to regulate the construction of sewers and the discharge of substances into the City sewage system. The Bylaw deals in detail with the prohibited discharges in Section 9. The Department of Engineering has tested "grab" and composite samples for pH, suspended solids, five-day B.O.D., grease, and organic solvents. A number of industries have been found to be contravening the bylaw. None of them have been prosecuted. They report they are all attempting to end their contribution to the problem and so far this has satisfied the City.

Industries contravening the Industrial Wastes By-Law as of April/71;

Allbright Plastics	Hill Park Secondary School
Allen Industries	International Harvester
American Can	Niagara Foods
Arcan Industries	Niagara Paint and Chemical
Baycoat Limited	Otis Elevator
Canadian Drawn Steel	Petrucelli Poultry
Casco Ltd.	Proctor and Gamble
Columbian Carbon Ltd.	Rheem Canada Ltd.
Dececchi's Poultry	Slater Steel Industries
Essex Packers	Stanley Steel
Frank Pipe Co.	Steel Co. of Canada
General Concrete Ltd.	Stelco Lagoon
General Electric Plant	X-pert Metal Finishing Ltd.
Hamilton White Trucks	

The city's sewage system cannot handle untreated industrial waste. Stelco of Canada is financing a major study through the Municipal Laboratories for the treatment of its industrial wastes. Dofasco has been allowed the right of way over Ottawa Street as part of their attempt to recycle water for the cooling of steel and acids from the pickling line. Proctor and Gamble discharges some industrial wastes to the Bay of the same quality as storm water. The rest of their wastes enter the City sewage system.

Industries involving food processing can be extremely detrimental to the treatment of wastes. Milk products and blood decrease the efficiency of the primary treatment plant while grease products can cause the sewers to block up and lead to expensive and extensive repairs to the sewage system.

The Industrial Wastes Control aims to sample industrial effluents, investigate complaints regarding industrial pollutants, assist industries in locating sources of pollution and enforce the sewer bylaw. Now that people are aware of the situation, it is more likely that something will be done and this is at least a step in the right direction.

Hamilton has a further problem in developing some areas. The Beach Strip is still on septic tanks largely because the water table is so high that sewer installation is a very complex engineering feat. Certain areas of the mountain are so sparsely settled that connecting them to the City system would be extremely expensive. Further, septic tanks, where there is adequate drainage and low density housing, are a very efficient method of treating sanitary wastes.

There are four locations in the older part of the city known to be dumping untreated sanitary wastes into the Bay. These are largely due to engineering problems. There is an area along Aberdeen (less than a block) near the railroad underpass which dumps into Chedoke Creek due to a pumping difficulty. Along Wellington Street work is ready to commence to end the dumping there. Around Catharine Street there is a gradient problem and on Strachan Street there is a trunk sewer to be eliminated.

The problem is that the money is not available. The City is willing to spend money on theatre auditoriums, but it appears unwilling to allocate funds to improve the sewage or treatment facilities. The problem becomes one of priorities.

Burlington

The Town of Burlington is serviced by three sewage treatment plants. The Skyway Treatment Plant is of the extended aeration type, and was designed for a flow of six million gallons per day. As of July 12, 1971, the plant was treating 7 m.g.d. This is still safe, but renders the treatment less efficient. The plant is due for a second expansion in 1972 and this time, the plant will probably be connected to the conventional activated sludge process, as this would mean the aeration tanks would not have to be expanded. Due to the longer holding time, extended aeration requires more tanks than the activated sludge plant of the same capacity. Therefore, adaptation to the conventional activated sludge process would allow the plant to expand to four times its present size without having to add new aeration tanks.

The initial installation of an extended aeration plant was an experiment by the Ontario Water Resources Commission who completely financed and now run all the Burlington plants. The Skyway plant is pumping some raw sewage to the nearby C.C.I.W. for tests there.

At the other two Burlington plants, Drury Lane and Elizabeth Gardens (capacity 2.5 m.g.d. and 0.75 m.g.d. respectively), tests are being conducted for phosphate removal in conjunction with their regular operations. The two small plants are to be phased out and all the sewage to be run through the Skyway plant as soon as it is capable of handling all the influent. Presently, the Drury Lane and Elizabeth Gardens plants discharge their effluent into Lake Ontario while the Skyway plant discharges into the Bay. The sludge from the Burlington plants is buried at the Town dump.

Central Burlington is on a combined sewer system. Any new areas are on a separate system. Certain areas of the Town are still not serviced by sewers.

Township of Saltfleet

The sanitary sewage from the township of Saltfleet is treated by the City of Hamilton at their Woodward Avenue sewage treatment plant, where the final affluent is discharged. The township does not have combined sewers.

Waterdown

The Waterdown Sewage treatment plant is run in conjunction with the Burlington Plants. It is a conventional secondary plant run by activated sludge. The resulting effluent is dumped into Grindstone Creek.

Dundas

Within the core of the study area Dundas is a unique feature. It has a completely separate sewage system. In the 1920's, when sewage became one of the services demanded of a community, combined sewers were cheaper and therefore were the ones constructed. Dundas has avoided this pitfall by installing a separate system from the beginning.

The Town is serviced by an activated sludge plant with a 2 m.g.d. capacity. The plant services 98% of the Town's homes. Those not serviced are remote. The plant was built in 1962 at a cost of \$400,000. It has since been enlarged and is now worth about one million dollars. Operating costs are about \$100,000 annually. The Town paid for the plant without any O.W.R.C. aid, and it is run and operated by the town. The effluent which is dumped into the Desjardins Canal is chlorinated year around according to O.W.R.C. specifications.

Five day B.O.D. samples are sent to the O.W.R.C. for testing. These samples register above the 85 p.p.m. required by the O.W.R.C.

Sludge from the plant is used by various members of the community as a fertilizer. People can pick it up at the plant or have it hauled to the desired location at the town's expense.

The only problem Dundas seems to have with its sewage system is that of what can be dumped into the sewers. They abide by the O.W.R.C. model by-law as far as what can be discharged into sewers, but prosecution of offenders can be a ticklish political situation.

Ancaster

At present Ancaster is entirely served by a septic tank system. The Medical Officer of Health has forbidden any further development in the area until it is serviced by storm and sanitary sewers.

Ancaster is to link up with the Hamilton Sewage System and rely on the Woodward Avenue plant for all treatment. This summer (1971) the O.W.R.C. has granted Ancaster five million dollars toward construction of its own sewers. Another five million is required to complete the project, but its source has not yet been determined. It is presumed that Ancaster will have to pay Hamilton for the sewage treatment, but the details are not yet known.

Oakville

The town of Oakville is serviced by a separate sewer system. Seventy-five percent of Oakville is serviced by sanitary

sewers and only twenty percent is serviced by storm sewers.

The town has two sewage treatment plants both of which provide secondary treatment. The South-east plant has a capacity of 6 million gallons per day. The effluent from the plants is chlorinated and then dumped into Lake Ontario.

Milton

Milton has an existing primary treatment plant and a second primary plant has been proposed; no plans for a secondary treatment plant are available.

Small villages in the study area rely on septic tanks or lagoons. These areas were not intensively studied.

CONCLUSION

Besides the basic recommendation that all combined sewers should be replaced by a separate system throughout the study area, there is an additional area for thought. If we wish to preserve our environment, we must realize that we can only do this by altering or modifying present use of our natural resources. If we wish to return our waste waters to the Bay in a relatively pure state, we must be willing to spend money to do this. The only place this money can come from is from the people that use the services provided. The irony of the problem is that the technology to provide today's necessary services was available decades ago. We could have saved ourselves a lot of heartache if we had been willing to provide the best services at that time instead of installing then what amount to second-rate services, and having to pay for the best services at today's or tomorrow's inflationary prices.

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INTERVIEWS

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2. Mr. Peter Marko,
City of Hamilton Engineering Department
3. Mr. Les Sharman,
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5. Mr. A. V. Forde,
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CHAPTER FIVE

AIR QUALITY

john hatton

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INTRODUCTION

Air pollution, as defined in the Air Pollution Control Act of 1967, is "...the presence in the outdoor atmosphere of any air contaminant or contaminants in quantities that may cause discomfort to or endanger the health and safety of humans, or that may cause injury or damage to property or to plant or animal life, or that interferes with visibility or the normal conduct of transport or business".¹

EFFECTS OF AIR POLLUTION

Health

Little doubt can be left in the mind of any informed person about the dangers of air pollution to man's health. Evidence that this is true would be too lengthy to list here but I will cite a few studies to put the situation in perspective.

The New York State Department of Health says that the number of people dying from lung ailments in New York is doubling each year.² A study conducted by the Environmental Health Branch of the Provincial Health Department shows that Hamilton male death rate from lung cancer is 46% above the provincial average, while non-industrialized cities such as Ottawa and London show above average rates of 5% and 3% respectively.³

Weather and Visibility

The higher concentration of particulate matter provide more surface area where water droplets can condense. The injection of these condensation nuclei could cause an increase in fog, rain and snow. The famous Grey Cup Fog Bowl of 1962 was an air pollution episode of this type.

Vegetation

Injury to crops and trees resulting from air pollution has been clearly established. Visible markings and premature death of the plant are examples of air pollution damage. In Hamilton, Dr. Cecilioni found that plant life (such as garden vegetables) growing in parts of the city which enjoy high concentrations of airborne contaminants contained large amounts of these contaminants when analysed, and exhibited damage to leaves, concurrently reducing the green surface area needed for photosynthesis.⁴ Such damage to plant life should be a warning to man.

Material Damage

Another direct loss due to air pollution is soiling and property damage. The cost of cleaning and laundering results in increased economic expenditure. Pollutants shorten the life span of many materials such as rubber or nylon. Surface coatings such as paint are damaged to a great extent by the interaction of contaminants - this is readily seen when one examines the paint of an automobile that is parked regularly near a polluting source.

PHYSICAL FACTORS AFFECTING AIR POLLUTION IN HAMILTON

Air pollution in any area has a direct relationship with the physical characteristics of that area. Three major controls act upon Hamilton's wind regimen: topographic set-

ting, urban morphology and proximity to the Lake.⁵

Topography

Hamilton has an unusual location in that it is hemmed in by the Niagara Escarpment. This 325 foot barrier hampers normal air ventilation and movement. The Dundas Valley funnels the wind into a westerly or south-westerly direction. Winds in the Hamilton area come from the east 20% of the time, from the south-west 27% of the time and from the west 35% of the time.⁶ Considering the extent to which Hamilton air is already polluted, these figures indicate the precariousness of pollution sources being established to the south and west of the city.

This westerly wind tends to disperse much of the pollution across the "beach strip" and out onto Lake Ontario. Were it not for this "cleansing" westerly wind air pollution in Hamilton would be much worse.

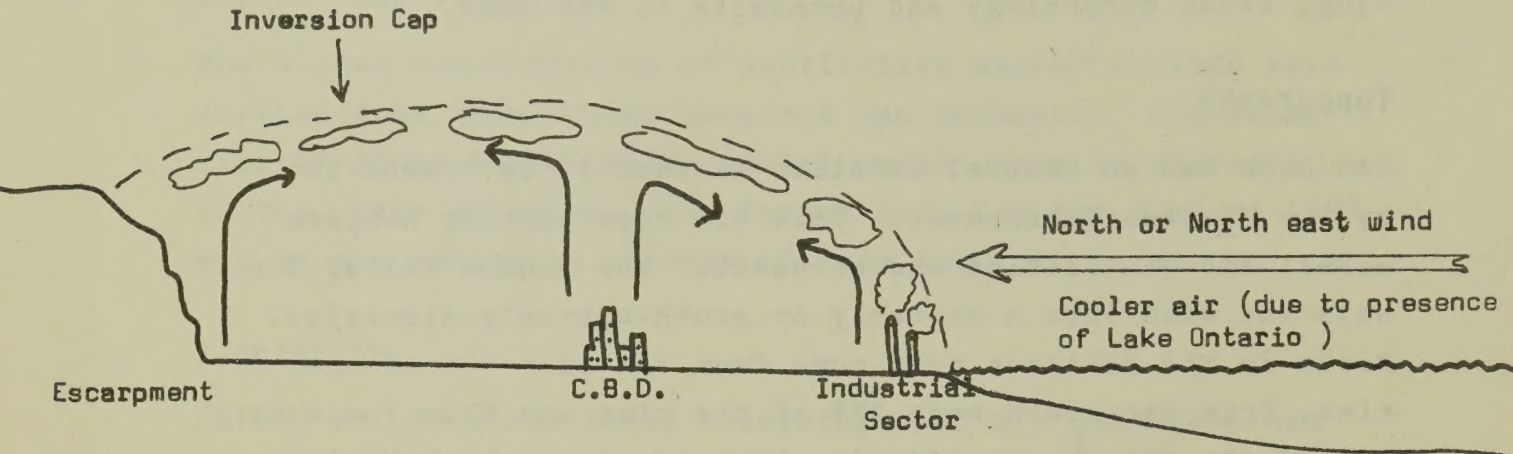
Urban Morphology

The two main sources of air pollution in Hamilton are the industrial sector and the central business district. The industrial sector holds two major steel plants, chemical, electrical and machine industries. The central business district contains multi-storied buildings in a fairly close network. Much of the industrial sector is placed in the most favourable location so that most of the contaminants are blown away from the city. But by no means is the total air problem alleviated.

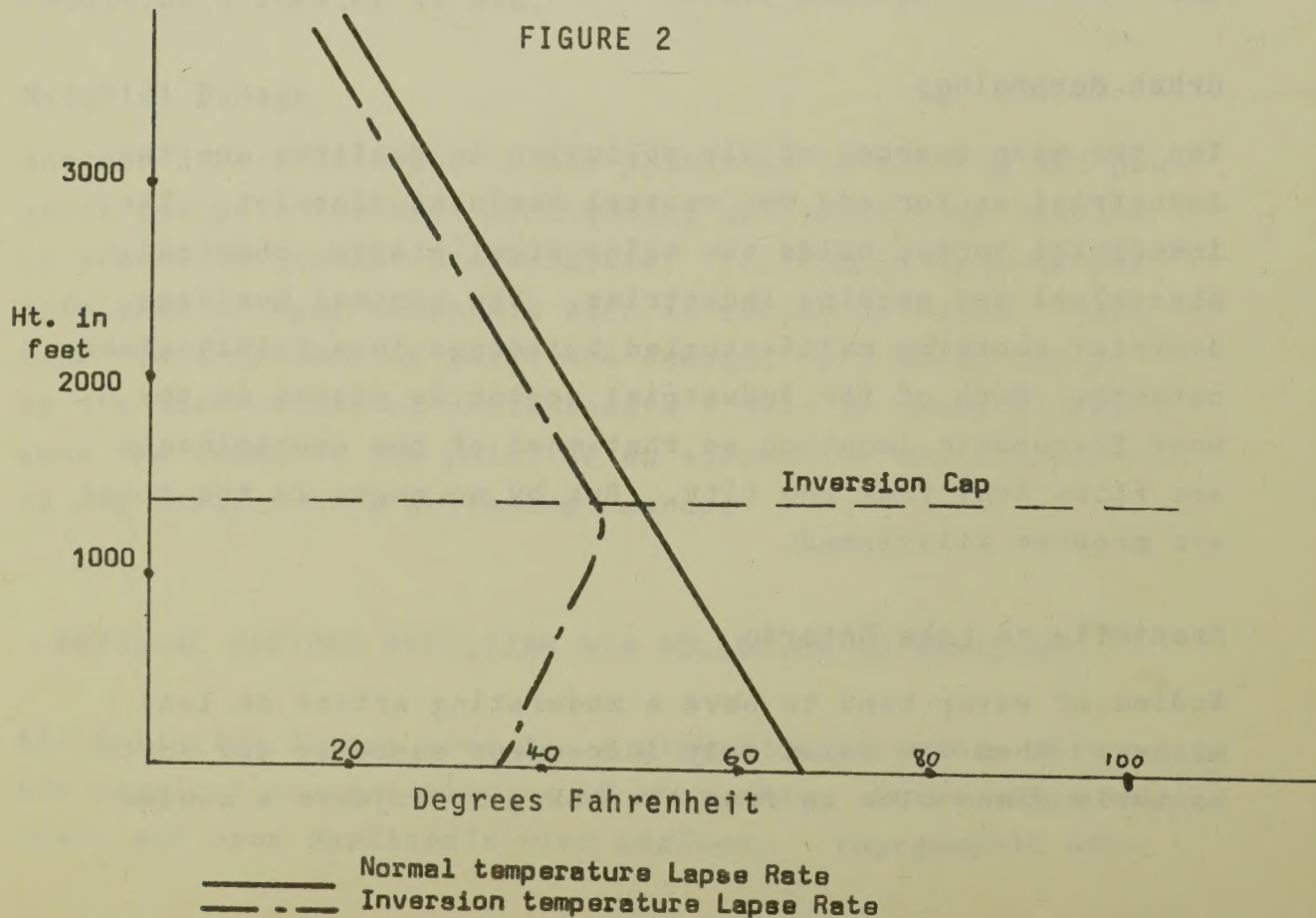
Proximity to Lake Ontario

Bodies of water tend to have a moderating effect on land masses. When the relatively infrequent easterly and north-easterly winds blow in from the Lake, it injects a cooler

North to South Crossection of Hamilton



NOTE: When the easterly or north easterly winds blow, the cooler air from the lake is forced under the warmer heat island created by the city. This creates a condition where the temperature increases as one goes higher. Since air does not move from cooler to warmer places, it is trapped as are the air pollutants. This is known as a temperature inversion.



mass of air under the warmer city air (see figure 1). This creates a condition known as a temperature inversion (see figure 2). Inversions are produced by other means, but in Hamilton this is a frequent cause.

An inversion coupled with the effect of the Escarpment "wall" locks the lower air under an impermeable cap. If emission sources continue to produce pollutants, the air pollution index will rise sharply due to the lack of normal dilution by ventilation from the upper atmosphere.

MAJOR AREAS OF AIR POLLUTION IN HAMILTON

Isoline maps (see figure 3) show that Hamilton contains two major pollution cells: the Central Business District, and the North East Industrial sector. During the Stelco strike in the summer and fall of 1969, the industrial pollution cell disappeared when a westerly wind was blowing.⁷ This indicates the degree to which one air pollution source such as Stelco is significant to the whole pollution picture in Hamilton (see figure 4).

ONTARIO AIR POLLUTION ACTS AND REGULATIONS

If we are to have any control over our air, we must have both effective legislation and efficient enforcement. The toughest laws are ineffective if not enforced.

Before 1967, air management came under the jurisdiction of the municipalities. At that time there were only four full-time people employed by civic governments in all of Ontario. Obviously, not much control or enforcement was exercised in

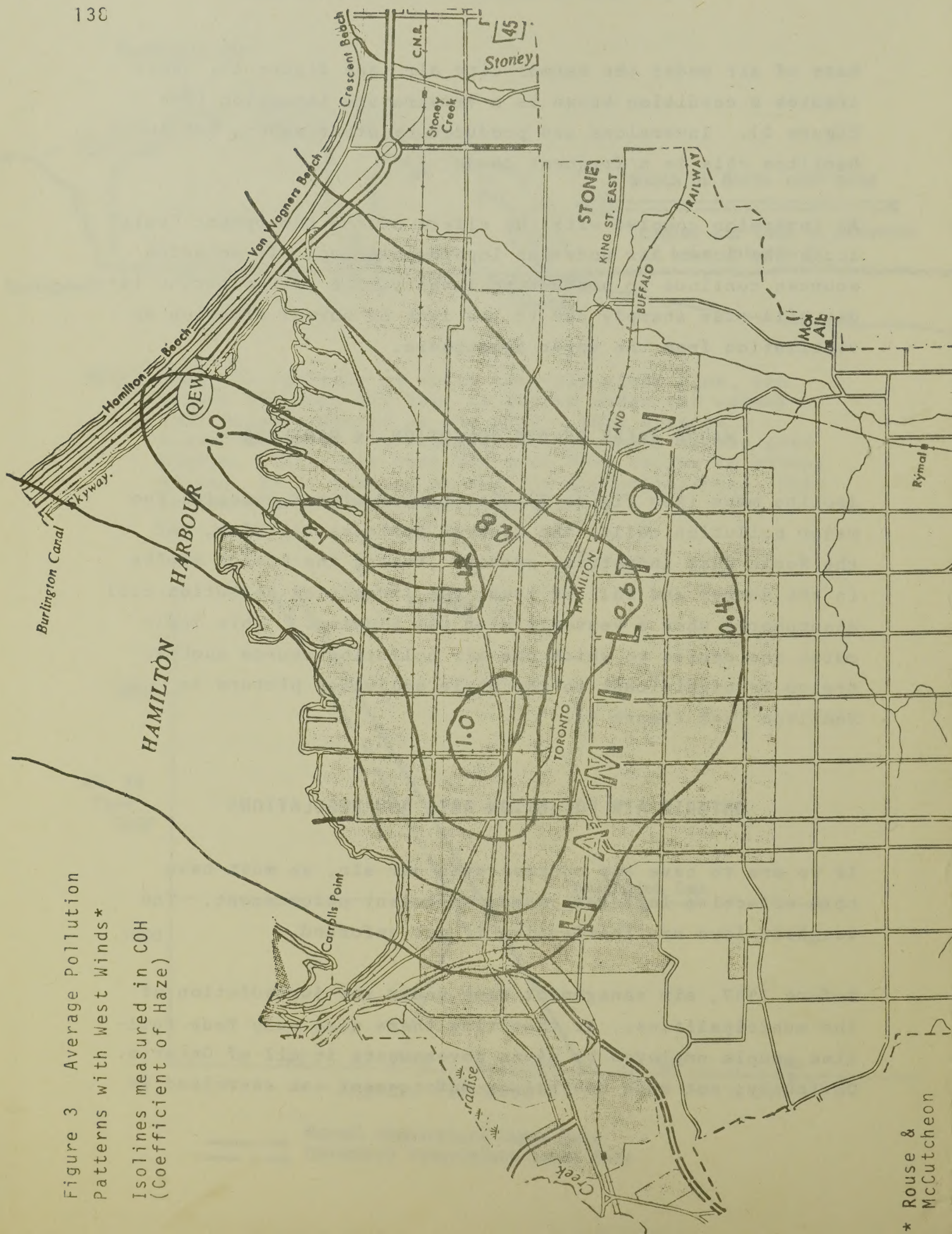
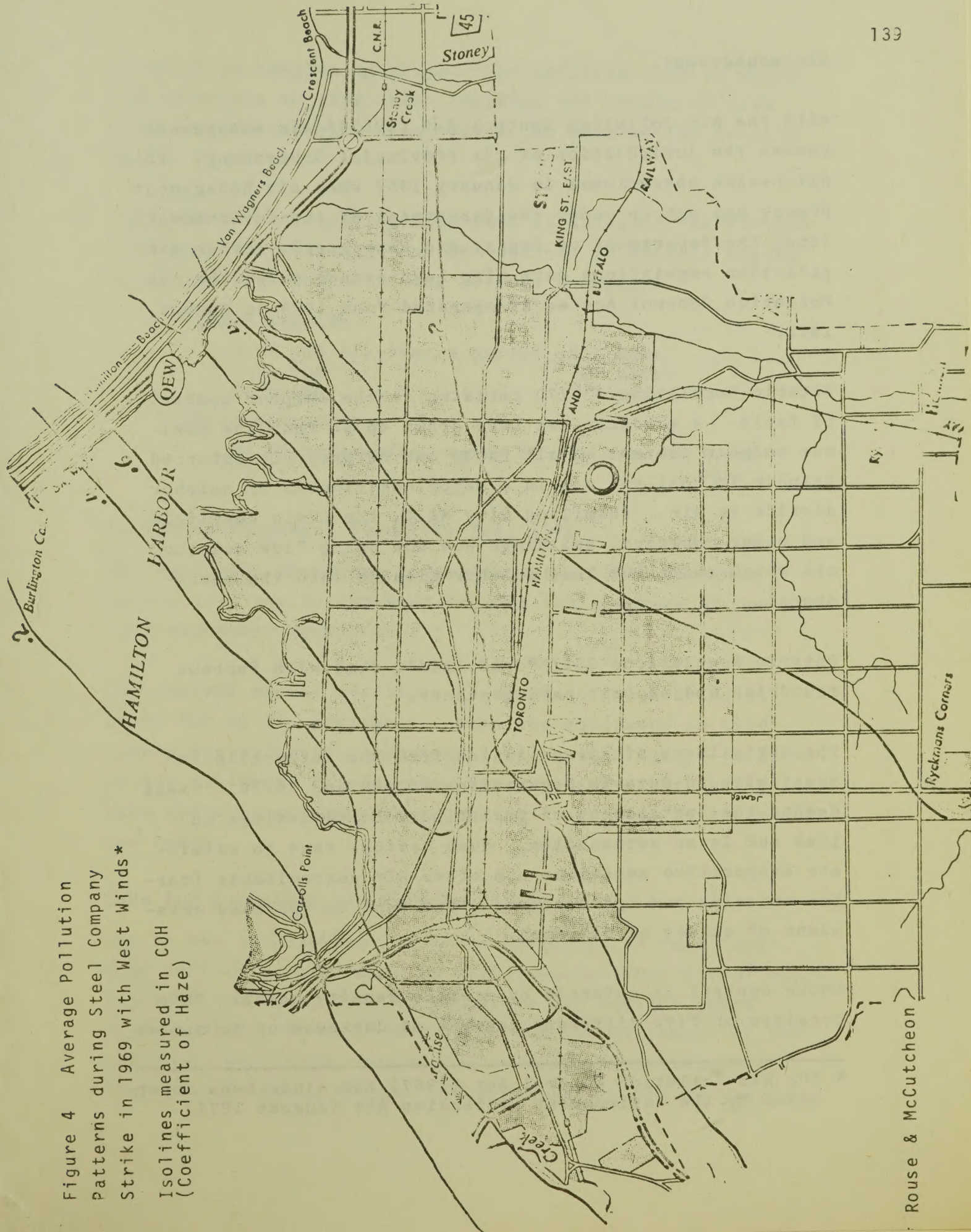


Figure 3 Average Pollution
Patterns with West Winds*

Isolines measured in COH
(Coefficient of Haze)

Figure 4 Average Pollution
patterns during Steel Company
Strike in 1969 with West Winds*
Isolines measured in COH
(Coefficient of Haze)



air management.

With the Air Pollution Control Act (1967)* air management became the jurisdiction of the Provincial Government. This Act became operational in January 1968 when Air Management Branch was set up under the Department of the Environment (then the Department of Energy and Resources). Other air pollution regulations have also been passed under the Air Pollution Control Act as it operated from 1968 to August, 1971.

Ontario Regulation 374/70 pertains to the sulphur content of fuels. A schedule has been drawn up so that the maximum sulphur content of all fuels can be properly enforced. Sulphur in coal and oil is a major contributor of sulphur dioxide to air. (Hamilton City Hall, the Civic Hospitals and other municipal buildings are now using "low sulphur" oil which emits 60% less sulphur dioxide into the atmosphere).

Ontario Regulations 288/69 and 111/70 deal with ferrous foundries and asphalt paving plants.

The curtailment of air pollution from the automobile is dealt with in Ontario Regulations 403/69 and 18/70. These demand the installment of pollution control devices on 1969 and later automobiles. Such devices tend to eliminate evaporative emissions and other air contaminants (carbon monoxide and hydrocarbons), but tend to increase emissions of oxides of nitrogen.

Smoke control is enforced by a smoke density chart. This consists of five different degrees of darkness up to number

* The Air Pollution Control Act (1967) has since been superseded by the Environment Protection Act (August 1971)

5, which is completely black. The criteria used in matching emissions to this chart includes the length of time during which emission takes place, as well as the density of the smoke.

Criteria for air quality have been established for fifteen different contaminants, and are defined in Ontario Regulations 133/70. The following are two examples:

Sulphur dioxide

0.25 ppm	air over a period of 1 hour
0.10 ppm	" 24 hours
0.02 ppm	" 1 year

Particulate matter

90 micrograms/cu. metre	of air over 24 hours
60	" 1 year

Pollution Abatement Incentive Act, 1970

The Pollution Abatement Incentive Act of 1970 provides grants that can be obtained towards the purchase of pollution abatement equipment.

The maximum amount available is equal to the Provincial Sales Tax on the equipment. When the equipment is used solely for pollution abatement, the maximum amount is given. If the equipment is also used for purposes other than pollution control, an appropriate amount is granted on a percentage basis.

Code For Livestock and Farm Buildings

Due to the encroachment of urban dwellings on farm lands, some sort of control must be placed on construction of odorous farm dwellings such as piggeries and poultry coops.

"A Suggested Code of Practice for the Establishment of New Livestock Buildings, Renovation of Existing Buildings and Disposal of Animal Wastes" was prepared in 1970 by the

Department of the Environment (then Department of Energy and Resources Management), Agriculture and Food Division. The Code stressed the need for adequate distances between livestock and poultry buildings and neighbouring dwellings. The Department will aid farmers in deciding upon such placement, at their request.

AIR MANAGEMENT BRANCH

Air Management Branch possesses a wide range of powers through the Environmental Control Act. They have the authority to:

1. Conduct air quality and meteorological studies;
2. Establish acceptable air quality levels;
3. Inspect and regulate all sources of air pollution (industrial, residential and institutional);
4. Order, after investigations, the discontinuance of the discharge of any air contamination;
5. Initiate legal action for violation of either a regulation under the Act or a ministerial order to improve a pollution situation.

Air Management Branch is divided into six sections.

1. Abatement: this group tracks down and seeks out correction of the pollution situation;
2. Approvals and Criteria: evaluation of the efficiency of air pollution control devices. Responsible for establishing criteria for acceptable levels of air quality;
3. Automotive Emissions Control: enforcement of regulations controlling vehicular emission;
4. Air Quality and Meteorology: measurement of air quality in the specified area;
5. Phytotoxicology: investigation of suspected air pollution injury to all types of vegetation;

6. Laboratory: provision of analytical service of a chemical nature and carrying out of applied research and development and research.

There are many regional and district offices located across Ontario. Their task is to pinpoint pollution sources. At the present time the Hamilton office is located at *554 Main Street East (525-7910)*.

Individuals responsible for air pollution are given a ministerial order which outlines the measures to be taken to abate their pollution activities; a period of time is specified within which the offender must install the necessary pollution control equipment. If the polluter does not abide by these suggestions, he may be taken to court. Convictions carry a \$2,000 fine for individuals and \$5,000 for companies. The public can aid the Air Management Branch by reporting any known polluters to the district office.

Air Management Branch is presently conducting an inventory of all emission sources in the Hamilton area. This inventory is due to be completed by January, 1972. There are three types of sources:

- Point Sources - heavy polluters such as foundries and thermal power plants;
- Area Sources - cluster of many relatively small polluters, e.g., concentration of high-rise apartments;
- Line Sources - roads, streets and thoroughways of a heavily-used nature.

Every emission source is broken down into its different chemical composition (SO_2 , particulate matter, N_xO_y , CO, HC). At present a dynamic model is being developed for computer analysis that will combine wind field data with

the emission inventory. This model will predict pollutant movement in the atmosphere and will hopefully be able to predict episode levels before they occur. With this type of data available, it is to be hoped that stricter control over air quality may be possible.

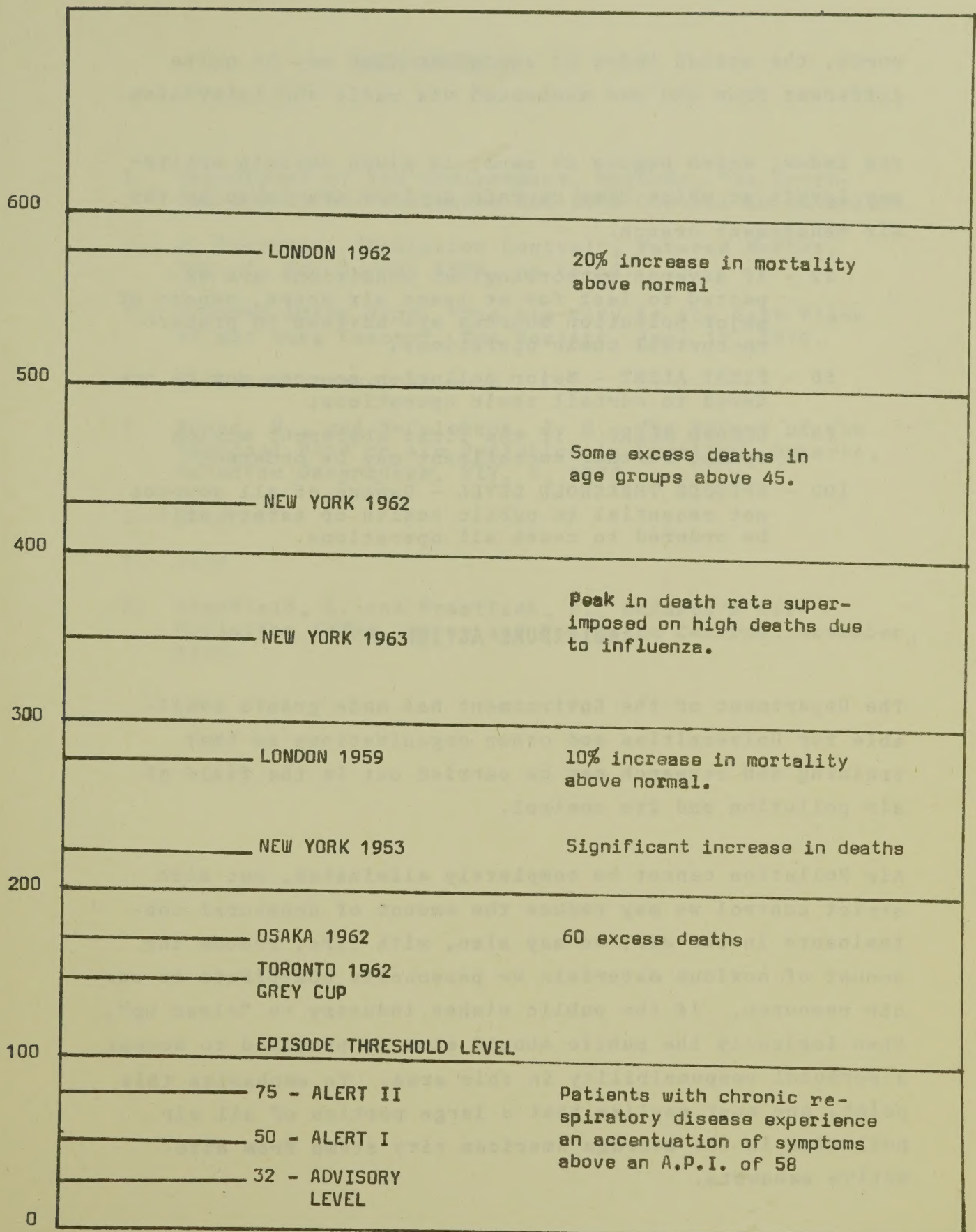
AIR POLLUTION INDEX

The Air Pollution Index has been established by Air Management Branch to provide an indicator of a build-up of noxious substances during periods when stagnant weather conditions persist. The Index is not solely dependent upon the amount of pollution emitted into the air. Weather conditions must be pollution prone to bring about a high Index reading. For example, even though the Index may be zero, the emission sources could be emitting more air contaminants than they do during air inversions.

The Index was inaugurated in June 1970 in the Hamilton area. Only particulate matter and sulphur dioxide are used as a basis for the Index. Hydrocarbons, oxides of nitrogen, oxidants, hydrogen fluoride and carbon monoxide are not included when the index is calculated. This is justified by Air Management as follows:

"Epidemiological studies indicate a relationship between severity of health effects and the degree of air pollution measured by concentration of particulate matter and sulphur dioxide.⁹

The readings are taken every hour, so that a constant surveillance may be maintained on the air quality. However, the pollution index reported to the public during weather forecasts is the average for the past 24 hours. In other



⁸Shenfield and Frantisak, "Ontario's Air Pollution Index", Water and Pollution Control, Nov. 1970.

words, the actual index at any given time may be quite different from the one announced via radio and television.

The Index, which begins at zero, is given certain arbitrary levels at which time certain actions are taken by the Air Management Branch.

- 32 - If adverse meteorological conditions are expected to last for at least six hours, owners of major pollution sources are advised to prepare to curtail their operations;
- 50 - FIRST ALERT - Major pollution sources may be ordered to curtail their operations;
- 75 - SECOND ALERT - If the first abatement action fails, further curtailment may be ordered;
- 100 - EPISODE THRESHOLD LEVEL - Owners of all sources not essential to public health or safety will be ordered to cease all operations.

INDIVIDUAL ACTION

The Department of the Environment has made grants available for Universities and other organizations so that training and research may be carried out in the field of air pollution and its control.

Air Pollution cannot be completely eliminated, but with strict control we may reduce the amount of unnatural contaminants in the air; we may also, with care, reduce the amount of noxious materials we personally contribute to our air resource. If the public wishes industry to "clean up", then logically the public should also be prepared to accept a personal responsibility in this area. To emphasize this point, one must realize that a large portion of all air pollution in the average American city stems from automotive exhausts.

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PART TWO

LEISURE AND RECREATION

THEY THAT
LEISURE AND RECREATION

CHAPTER SIX

ARE WE READY

hanita braun

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PHILOSOPHY OF LEISURE AND RECREATION

"Man does not live by bread alone" but has many needs for his proper development, both physical and psychological. One of his more advanced needs is that of recreation, or psychological renewal from the drudgeries of the more routine aspects of his life.

For many people recreation is environmentally oriented, taking such forms as camping, fishing, walking and cycling. Each of these has an environmental impact or impacts. For example, camping carried out in a trailer with many electrical gadgets has different needs and space requirements than the back-packer in a remote section of the Bruce Trail.

Man's living requirements also have an environmental impact. Life in high-rise apartments and row houses has now become an increasing pattern, but there still remains a need for contact with nature in the normal human being. These needs must be provided for by proper planning. The new Cluster Housing Developments - discussed later in this section - offer open space and green areas between housing concentrations. They are one possible answer to urban living.

With increasing automation the availability of leisure time is increasing for most Canadians. However, the use of free time needs to be considered in an environmental context, due to the increased demands it will place on our physical environment. Such usage of leisure time was considered at the Montmorency Conference on Leisure, Quebec, 1969.

Inputs to this inter-disciplinary conference came from the fields of sociology, psychology, philosophy, economics, recreation education, landscape architecture, social work, communications, government, labour and business. Increasing free time has the following implications:

1. For Government

- the necessity to establish priorities and the need for research on which to base decisions.

2. For the Individual

- increasing free time provides opportunities for personal fulfillment. Education must play a major role in counteracting boredom and dissatisfaction.

3. For Society

- free time allows for achievement of social goals but may cause conflicts between the demands of the social system and one's value system.

Dr. John Farina, Professor of Social Work at the University of Toronto, feels that "one of the failures of our society has been that we have failed to develop in our people the capacity to choose, and to choose in terms which will manifest self-expression. The capacity to choose must be rooted in our education system". Although we are at the beginning of a leisure age, the distribution of our work and leisure times are still those of an industrial age. In Dr. Farina's words, "basic daylight work schedules persist as though artificial illumination was yet to be invented".

Abraham Maslow's book, *Motivation and Personality*, describes the human hierarchy of needs. Basic lower-level needs must first be satisfied on a continuing basis to allow for attainment of satisfaction from higher-level needs. His classification of needs is as follows:

1. "Physiological Needs

- These include hunger, thirst, sex, activity, rest, homeostasis and bodily integrity. These are needs which once relatively well satisfied free the individual to address himself to the next set of needs."

2. "The Safety Needs

- In this group are the needs for orderliness, justice, consistency, routine, predictability, limits, physical safety. Adult expression of these needs is evidenced by interest in job security, savings accounts, and various insurance plans covering a variety of life's exigencies."

3. "The Belongingness and Love Needs

- These needs emerge after both the physiological and safety needs are fairly well satisfied. They include the need to love and be loved, the need for friendship, inter-personal relationships, and a sense of identify with a group."

4. "The Esteem Needs

- These are two sets of esteem needs, self-esteem and the esteem of others. The former refers to need for strength, achievement, adequacy, mastery, competence, and independence; the latter refers to prestige, reputation, status, dominance, recognition, attention and appreciation."

5. "The Need for Self-Actualization

- The emergence of this need usually depends upon the prior satisfaction of the needs at the four lower levels. It is the need for self-fulfillment, the need to become everything that one is capable of becoming."

When Maslow speaks of self-actualization, he assumes this will be without exploitation or sacrifice of others. Rather the satisfaction of such needs is likely to enhance the possibility of other's self-actualization.

This post-industrial age, our age of leisure for all, allows man to reach the highest level need, the ability to express his full potential as a human being.

The concept of leisure in Canada is an evolvement of our culture and environment. Large numbers of ethnic groups bringing their heritage to Canada has created a rich and varied cultural mosaic. Current international patterns of leisure activities emerge as the result of this inter-generation cultural heritage, and Canada is in the mainstream of this international leisure philosophy. Residues of prejudice and inter-cultural hostility indicate that some basic needs such as security and belongingness have not yet been fulfilled.

Dr. Marc Laplante, in his paper *Leisure in Canada by 1980*, states that "Canadians today still live in the work-oriented society which was developed 200 years ago". Unless our attitudes change a great number of social problems will occur.

Factors Affecting Recreation and Leisure

Man in general, is active until age 35, after which time he becomes selective about his activities. This is usually made evident by an increase toward spectator activities. After 45 years of age, leisure is usually desired to bring physical and mental relaxation. The age of retirement still remains the age of boredom and solitude for many senior citizens. Alternatives to the institutionalization of senior citizens in apartment complexes should be considered.

To analyze future leisure needs, one must study the present and future age structure of the Canadian population. By 1975-1980, the greatest increases in population are expected to occur in the age groups 0-9, 25-34 and 60 years of age and over. Based on increased population and life span the following hypotheses can be made:

1. Generally for those up to 45 years of age - an increase in outdoor activities and sports practices: camping, hiking, bicycling, skiing, horseback riding, sailing, swimming, fishing and hunting.
2. An increase in spectator activities and artistic sports events for all ages of our population.
3. Due to more free time and improved standards of living and transportation, a considerable increase in travelling. "Trends show that the interest will grow for local exotic events, rodeos and festivals, the life of old colourful towns, old forts, old military campsites, etc."

This last point ties in with Dr. Farina's emphasis that Canadian interests, for a large part, are in cultural exchange, historic places, and other aspects of our people's heritage. Emphasis must therefore be placed on maintenance of our historical and cultural sites for ourselves and for future generations. In far too many cases, historic sites are obliterated in the face of "progress". A quote from a recent article in the Toronto Daily Star illustrates this point.

The town of Port Elgin has been investigating the possibility of rebuilding the entire village as a tourist attraction but the site is in the middle of a housing development and the land may be too valuable to be retained for this purpose. By next year either there will be a reconstructed Indian village or all evidence of the settlement may have been eradicated.

Profession

Socio-Economic factors, in addition to age, reveal even more about the leisure patterns and trends in Canada. Studies indicate that leisure activities complement rather than compensate for professional activities. A connection is found between leisure behaviour and professional occupation. According to present indications, Dr. Laplante points out the following trends:

1. People working indoors have a greater need for fresh air and thus choose more outdoor activities and sports.
2. The rural population, with few exceptions, hardly participates in any sports.
3. Manual workers prefer group activities, meaning less individualism and more likelihood of forming teams.

Income

The level of income indicates difference in behaviour. Average income families can afford basic needs but not holidays and leisure activities. This is the plight of 2 out of every 5 Canadians who live in a state of cultural deprivation. An increase in income or relief from material distractions, however, does not automatically open the doors to cultural development. Cultural development and a better way of life in an age of leisure must be functions of new attitudes and changes in life style and priorities as well as increased financial resources.

Education

"Even if Canadians tomorrow have a high level of education, it is not certain that this phenomenon *by itself* will bring about major changes in the ways of thinking and living concerning leisure." Attitudes and ideas about a new lifestyle and encouragement for free thinking, individual cultural development and an ability for questioning and searching, must become integral parts of our educational system at all levels.

Socio-Economic Status

Trends indicate that the standard of living and the number of people with higher education is increasing. On this basis, Dr. Laplante projects some future aspects of leisure as they relate to socio-economic conditions.

1. The public will demand a greater diversity of activities.
2. There will be more experimentation and desire to use leisure to express freedom from traditions, puritanism and religion.
3. New types of relations will form between leisure and the social classes; some will use leisure to preserve their privileged status; others will pursue a new style of living; less privileged classes will hide behind tradition because of their inability to afford leisure activities.
4. An increase in popularity of individual activities will occur among the higher and upper middle classes. Attendance at organized leisure events and practical activities will increase among lower middle and upper lower classes.

In the future, clear divisions between classes is more likely to be intellectual. Socially and economically disadvantaged people, although aware of all possibilities of leisure, will be unable to participate. The poor classes will suffer from cultural isolation.

5. In the future, informal associations based on friendship will take precedence over formal social clubs, religious, political, trade unions, etc.

Urban Influence

As urbanization increases, the problems of leisure increase. "Canadians, because they live in cities and often in large cities, will have a *particular longing for the rest of nature*, for trips in the country and abroad. Because their cities have expanded overnight and all look alike, they will search for the colourful, for old stones full of history, etc. The urban phenomenon will therefore, strengthen the trends already mentioned."

Professor Norman Pearson in his paper entitled *Planning for a Leisure Society*, emphasizes that a satisfactory planning process in relation to our environment, has not been evolved in Canada; a fact which makes a mockery of our hopes and

aspirations for a leisure society. Within the next generation, as much development will be put on the ground in North America as has occurred since white man first came. Because of the irreversibility of many of the changes to our landscape, planning must form an integral part of the process of change. This planning process must involve people and their needs for a common social and environmental benefit. Basic needs amenable to planning techniques are:

1. The need to get some instrument to make our federal, provincial and municipal governments work in concert within a regional context. We must get some accountability and coordination in our planning process.
2. The next basic need is really hitting some of the fundamental values, namely the question of land. The question in planning is one of compensation and betterment. Our techniques of land assembly are crude; urban renewal has come to a complete impasse at this point and most of our planning has crumbled because of our unwillingness to change obsolete private land use rights. There is a need to obtain large areas of public land via nationalization of land, or obtain public use of land by a redefinition of the rights of private property. *We still have pioneer attitudes to land and we are making urban demands upon it.*
3. In conjunction with the need for incentives for land banks goes the need to enunciate very clearly the broad strategic objectives of our environmental plans as keys to individual decisions.
4. The need for producing a plan for leisure in very practical terms, in each region, in each area, to work out minimum standards for the whole range of activities, for the entire population, so that these can be translated into space demands that a planned can "put on the ground".

5. The real challenge is summarized in the question of fitness of our environment and the quality of our experience. We cannot afford to just play around with our surroundings - they are too sensitive for that. Everything we talk about as a problem in our society always comes back to the problem of numbers of people; too many people in areas which have not been adequately prepared for this large number of people.

Problems of planning for a leisure society must go hand in hand with an attack on regional disparities and the problem of poverty. Such problems are further complicated by a great lack of research. However, some implications can be pooled from several studies:

1. Although affluence is spreading there still remain 20-30% of Canadians who do not have enough "food, health, shelter and disposable income or meaningful activity to give even basic satisfactions, let alone a hint of leisure".
2. Whole regions live in a different world of near-deprivation.
3. Even for the more affluent, lack of planning in the past for the future imposes severe restraints on full enjoyment of existing leisure
 - space reservations for recreation are presently inadequate and future shortages will be grave in heavily populated regions
 - "Park distribution is not compatible with that of the population"
 - "the findings of the *Canada Land Inventory* studies with respect to *Land Capability for Recreation* have not yet been translated into policy recommendations"
 - no effective coordinated joint Federal-Provincial regional planning exists to remedy these problems
 - the complexity of legal and administrative machinery hampers proper planning

- urban areas are frequently unaesthetic, badly laid out and generally the antithesis of a leisure setting
- we have not accepted the possibility that by 1980 the average work-time will be 10% less than now
- in 1962 or 1963 the urban area available for public recreational use such as parks, golf courses etc. ranged below 10%, none of the sample cities anticipate very much alternation in land ratio by the year 1980, despite increase in population.

Studies done in Hamilton for the new official plan show that, even at the modest standard of one acre of parkland per 1,000 people for neighbourhood parks, only about 30% of the 200,000 people in the lower city (between the escarpment and the harbour) have adequate access to these parks.

The problems of space for leisure occur at a time when agriculture is in retreat and it should be possible to stockpile this land as a safeguard against land speculation and the urban shadow. Such a landbank is now being used in Edmonton and should become a national policy. Various studies have shown losses of farmland to urbanization in the Toronto-Hamilton areas to range from 382 acres per 1,000, to 785 acres per 1,000 people. It was estimated that by 1990, the Fruit Belt of Southern Ontario will disappear if urban sprawl and urban-shadow consequences are allowed to continue at the present pace, without protective legislation.

As a result of such failure to plan ahead, "Hamilton lost a proposed gift of a planetarium because it was unable to find a site in its central area, and citizen funds raised for a civic theatre-auditorium were idle due to problems of coordinating federal, provincial, municipal and private development".

Professor Pearson put forth several valuable recommendations on how we can begin to plan for a leisure society.

1. "We will have to control our numbers."
2. "We will need to adopt a positive, definite and sustained guidance to manage all our resources and all our environment."
3. "The great political lesson must be the unity and fragility of our environment; the unity of man and nature; the impossibility of avoiding ecological controls *without present or future disaster*; the great responsibility of the political leader to carry out this trust."
4. "There is a vast need for improvement in the arrangement and the tasks of central government at federal and provincial levels to allow whole responses to regional problems."
5. "We must recognize pollution as the symptom of the mismanagement of environment."
6. "We must 'think through' the implications of technology."
7. "Our nation must devise a regional structure which allows comprehensive resources management and joint federal-provincial-municipal planning."
8. "Nearly all our urban areas need to be unified and our conurbations need a structure of government related to their physical and socio-economic hinterland."
9. "We need at the federal level a *concept of national development, guiding the flow of the tide of population, and a federal-provincial land policy. Some of the growth might better be diverted to new urban areas to ease the environmental problems of those now existing.*"
10. "We must make every effort to establish a '*national minimum of civilized life*' for all Canadians as a prelude to leisure."

11. "We must devise administrative measures which are more flexible and more imaginative, including new techniques for assessing cost-benefit ratios on the basis of a concept of "social cost and benefit". In the same way we must introduce concepts of the value of amenity, wilderness, open space and country areas. The economists must learn how to assess the value of a tree, or a bird, or a beautiful building."
12. "We must devise incentives which will result in the possibility of "an environment for leisure". An example is the need to find ways of avoiding land dereliction and waste of resources, and ways of sharing any costs involved."
13. "Governments at all levels must recognize their duty to manage the environment as a basis for leisure."
14. "Perhaps most vital is the need to drastically improve the collection, retrieval, dissemination and actual use of information. It may be that the information we need already exists; or only needs integration to provide the basis for major advances."
15. "This throws us back to the basis for leisure - the capacity to use time creatively and constructively; and the existence of a people who can communicate effectively with each other."

From these recommendations Professor Pearson continued with several specific planning techniques:

1. A community development Act which required joint federal-provincial-municipal integrated planning as a basis for all tax expenditures.
2. Compensation-and-betterment provisions in planning legislation to minimize waste of resources.
3. Incentives for "land banks" to increase community advantage in the race for open space.
4. Production of a "plan for leisure" for each urban area, setting out minimum standards for the whole range of cultural facilities, and a program for implementation.

Planning legislation should provide for full participation of citizens at a local level to ensure that such citizens have involvement in the development of their environment. The first evidence of such a planning approach on a regional scale has resulted in the recently published *The Rideau, Trent, Severn - Yesterday, Today and Tomorrow*. Residents and transients alike were asked for comments on how that recreational area affected them. Regular public meetings were held in all communities involved, to inform them of new progress or lack of it, as well as to obtain their reactions and suggestions on planning proposals, ideas and information about historic aspects of the region. The importance of historical places in today's recreation was fully understood by those involved in that study.

A STUDY OF THE LEISURE NEEDS AND LEISURE ACTIVITIES OF CANADIANS

Public transportation and a better distribution of information concerning a wide variety of recreation areas must be made available to solve problems for such groups as the young, low income families, manual workers, residents of large urban areas (particularly in Ontario and Quebec), persons having no car, households with small children and persons unable to get along with other people. This last subgroup indicates the serious needs related to social and psychological factors which must be studied and consequently provided for in our recreational open spaces.

The quality of recreation often depends on a continuing experience, requiring stretches of open space to be enjoyed without having to cross highways or major streets. It is

amazing how many recreational needs could be effectively provided within the city itself, if careful research and planning (not paper planning) were an integral part of design for recreation. Activities such as 1) bicycling, 2) hiking and camping, 3) swimming and fishing (when unpolluted water is present), and 4) strolling (away from crowded sidewalks) could be provided for within the urban fabric if human needs were better understood and appreciated by more planners and politicians.

Numerous studies point to the fact that various people need different environments in order to enjoy the very same activity. In the case of camping, a significant number of people load their camper with modern conveniences. Thus part of their household becomes transplanted to a campsite which is often just a large park with a few trees. Others would not enjoy their camping experience if they had more than the bare essentials for survival somewhere in the wilderness away from any signs of civilization. Both of these needs must be satisfied, since each represents significant segments of the population. The point is, why must a person in the first category travel hundreds of miles to reach such a park (or give up camping because of lack of transportation) when the very same environmental facilities can be provided within a 30 minute drive from his home?

INTERCONNECTING AREAS WITHIN AN URBAN CONTEXT

Linkages (Green Belts)

Potential recreation spaces such as creek and river valleys, ravines and hills, can accommodate more activities than any

other configuration of the same acreage. Side by side such a recreation strip of uninterrupted space can accommodate walking, cycling, hiking, horseback riding, fishing and swimming. Providing connections in a park system requires elements such as safety crossing areas (i.e. foot and bicycle bridges) over roads with heavy traffic, and the possibility of using segments of private lands to connecting hiking trails or bicycle paths. The latter can be provided through long-term leases or through easements. An easement is a limited right over land owned by another person; thus there can be scenic, hiking camping or bicycle riding easements - to name only a few. (For more details see Chapter Seven, page 195.)

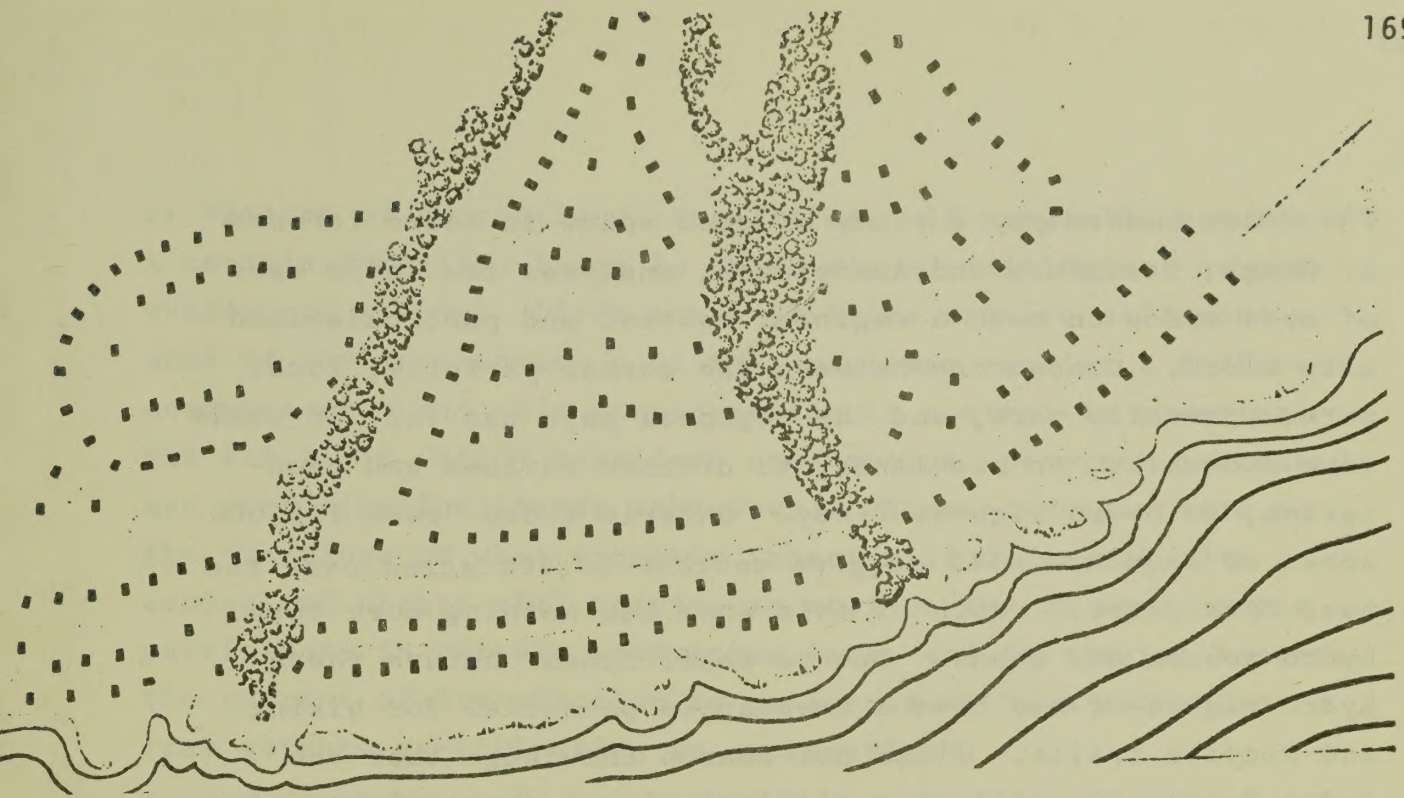
In the study *Outdoor Recreation for America* undertaken by the Outdoor Recreation Resources Review Commission, many valuable ideas and explanations are incorporated. "The most basic thing that can be done is to encourage the simple pleasure of walking and cycling."

The demand for adequate spaces for bicycle riding has skyrocketed in the past few years and continues to increase, yet very little attention is being paid to these needs. Many of our parks display NO BICYCLE signs and our roads are unsafe. Highways have been designed for the automobile with no provisions for slower types of transportation. The 50 or 60 foot right-of-way on either side of the highway for safe removal of cars could be redesigned to allow for a 10 foot bicycle path planted with shrubs to provide a visual screen. Europe which has even greater population densities than we do has much to teach us about building recreation into the environment. Holland has underway a national network of bike trails and in Scandinavia, buses going from a city to

the country-side have pegs on the side to enable people to carry their bicycles. Although car ownership is rising, they did not forget that walking and bicycling are the most popular and inexpensive sports and that almost everyone can participate.

One of the best opportunities for building recreation into the environment is in housing itself. The typical subdivision of post-war suburbia splattered houses all over the countryside in a rigid pattern of equal size lots and thus fouled the very amenities which people moved outward to seek. A new approach has been evolved. It has been tried and the results are excellent. This refers to cluster development (Fig. 1) where the houses are located in clusters which not only house the same number of people, but are more economically serviced with roads and utilities. Most important, only a fraction of the trees are cut and existing springs and streams do not become sewers.

If such superior methods have been successfully used, then why do we continue to approach every construction project bulldozer first and common sense second? Even in terms of economic returns (not considered number one priority in this report) designing with - rather than against - our natural environment is more advantageous. It has been proven in new residential areas throughout England and the U.S., and in Canada, mainly in new cottage subdivisions, that maintaining a majority of the trees and shrubs on the site has considerably raised the value of the house or cottage and has speeded up the selling time. It also saves the developer from investing in nursery stock, the benefits of which would not accrue until 20-25 years hence.



Same number of people accommodated in cluster subdivision below as in conventional subdivision above, thus leaving twice as much open space for recreation.

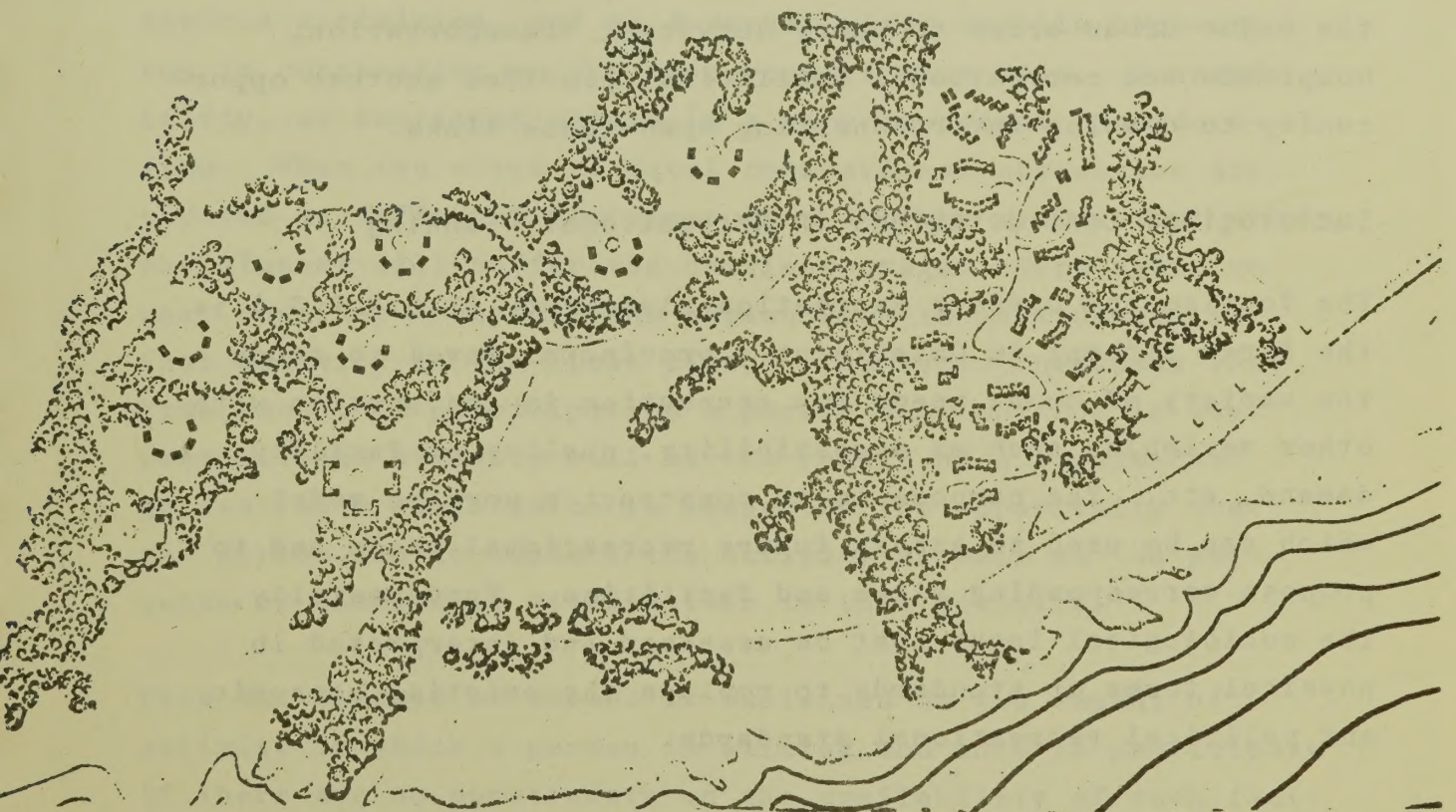


Figure 1 Cluster and conventional subdivisions.

The Urban Landscape, a study of open space in Metro Toronto by Hough, Stansbury and Associates, analyses the major uses of open space on both a regional context and particularized city block. Connectors between the corner parkette, local park, community park, and the regional park can vary in scale from sidewalks, to backlanes, to disused ravines and cemeteries, to hydro rights-of-way. Ontario Hydro "owns 115,000 acres of land and will acquire another 50,000 acres over the next five years." Much of this area has nothing more than hydro towers and weeds. Due to their linear nature these hydro rights-of-way have a tremendous potential for hiking and bicycle trails. It is not common knowledge that the Hydro Commission will very willingly lease these rights-of-way to be used as extensions of adjacent parklands. Zoning of hydro rights-of-way is according to adjacent use. The *Toronto Centred Region* study which plans a green belt around the major urban areas to carry services, transportation, hospitals and recreational facilities, provides another opportunity to develop interconnecting open-space links.

Sociological Considerations in Recreational Planning

The Tourism and Outdoor Recreation Plan Study (T.O.R.P.S.) is the first attempt in Ontario at a provincial level to study the variety of human needs for recreation in conjunction with other variables such as accessibility, quality of facility, demand, etc. The purpose is to construct a working model which can be used to assess future recreational needs and to propose corresponding sites and facilities. Fundamentally, the sociological input must be assessed and interpreted in physical terms or standards to replace the existing economic and political recreational standards.

It was found that data such as attendance at Provincial Parks, traffic volumes on highways, etc., do not indicate the success

or failure of recreational facilities. If people do not use a certain facility, there is obviously a sociological or psychological reason. Different activities require different uses of the environment - or they may even require a different environment - and this consideration is central in planning. The T.O.R.P.S. study considers consumption (resource pressure) and participation (human behaviour). These concepts lead to the questions of what economic impact will occur and what ecological change will result, as well as why do some people participate in certain activities only, and in varying amounts. The concept of distribution is explained as "the mechanism that matches participation to consumption".

Due to certain behavioural patterns, people *distribute* themselves throughout an area which offers recreational activities according to their ability or desire to *participate* in various activities, and as a result place certain pressure due to consumption on the resources of that area. *Accessibility*, as mentioned before is a very important consideration. When two sites of equal recreational attraction are located at different distances from a given residential area, the closest will suffer the heaviest usage. Here again we must consider - why did the person wish to participate in that activity in the first place? The report presumes that "the amount of participation a person will opt for in any recreational activity will be the result of a fundamental motivation process which is shaped by the opportunity that the person has to conduct the activity as well as the presence or absence of alternatives to that activity."

Thus the concept of demand is explained as the amount of activity in which a person is willing and able to participate if there are no constraints on the availability of such facilities or on the accessibility to them. Therefore, demand

represents the effect of all personal, economic and social factors on a certain recreational supply - without considering the effect of accessibility. If the opportunities for recreation are less than ideal, participation will be lower than demand.

This concept helps us understand why, for example, certain parks are used infrequently while nearby residents complain of a lack of recreational facilities. Simply providing a piece of land as parkland is not sufficient. Its play facilities, its landscape and its accessibility must be related to studies on how people use what facilities and when. "Environment for recreation cannot be created through monetary expenditures alone".

Of crucial importance is the awareness that the very resources which are best for recreation are those which cannot be mass-produced and very often cannot be reproduced at all - a trout stream, a shady forest, a clear lake - the list is endless. Learning to enjoy and benefit from such an environment without destroying it is one of the tasks that confronts our society today. The social danger for those people living in an area which lacks environmental amenities to the extent that it inhibits them from developing their full capabilities has become evident. Leisure activities play a vital role in the social development and well-being of individuals.

In terms of planning, the above concepts can be translated into the following questions:

1. What types of facilities or amenities and in what number does an area require?
2. What degree of recreational use can an area accommodate without environmental damage?

These questions are inter-dependent and thus represent the most vital aspects of recreation, the human need and the ecological need. Man and his needs cannot be separated from those of his natural surroundings.

Environmental Awareness

The awareness that land has certain needs before any development takes place is vital to the success of recreational developments. If a recreational area is misused or overused it will be unable to provide those qualities of life which attracted us to it in the first place.

Unfortunately few studies are concerned with the impact of various activities on various environments. One of these is being conducted at the University of Toronto under the coordination of Prof. Glen Bird, entitled, "A Systematic Research Approach to Water and Land Capabilities for the Recreational Development of the Inland Lakes of Ontario" is sponsored by the Ontario Department of Municipal Affairs, hereinafter referred to as the "Lakeshore Parameters Study". The project intends to obtain, through the careful study of a number of parameters related to land and water eco-system, the degree of development which a lake and its surrounding watershed will support without irreversible ecological imbalance.

It is an exciting and much needed study which sees land, water and the life they support (fish, wildlife, vegetation) as an inter-related system; affecting the quality of one part results in changes elsewhere within the system. The study group is multi-disciplinary, involving experts in pollution control, air-photo interpretation, ground water, fisheries and wildlife ecology, resource management, hydrology, geology

and socio-economics. The integral part of this study is being carried out in three phases.

Phase one is an analysis of existing studies of human resources which formed the initial input to the study. From this investigation the following will result:

- (a) a list of all parameters affecting the water and land capabilities for recreational development, considering the lake, its entire drainage basin, and possible connection to a waterway system.
- (b) a division of the parameters into broad groups based on the significance of their effect upon water quality, and their importance to particular recreational land uses.
- (c) identification of knowledge gaps where further research is required.
- (d) selection of a number of lakes for detailed investigation based on their suitability for the required research. Broad parameters such as physiographic region, size, depth, stage and type of present development, watershed characteristics, existing water quality, etc. will also be considered in the selection of test areas to achieve a representative cross section of the types of lakes in Ontario.

Phase two will determine from this input the relative importance of each parameter to withstand existing and anticipated recreational land uses and will define the following:

- (a) The major parameters affecting each specific recreational land use.
- (b) The development of the most economical and efficient system of obtaining the necessary parameters in order to determine the proper category for the lake under consideration.
- (c) The relative importance of each of these parameters and an approximate weighting factor for each, the summation of which would indicate the water and land capability of that lake and watershed area to withstand each recreational land use.

- (d) The number of categories which the lakes of Ontario could be placed, based on similarity of physical characteristics.
- (e) A series of guidelines for logical constraints for each type of recreational land use and lake category.

Phase three will involve the synthesis of socio-economic factors with the findings of the preceding two phases.

Some of the parameters being considered are: basin topography; chemical and biological variables; the impact of recreational activities on the water, on the shoreline and within the watershed; and existing land use within the watershed. These field investigations are expected to have the following results:

- (a) a critical review of existing water quality criteria and standards and evaluation of their applicability for the recreational use of lakes.
- (b) the development of more effective equipment and techniques for the detection and monitoring of the physical and chemical parameters related to recreational land capabilities.
- (c) the significance of indicators (i.e. algal and phytoplankton productivity) and their relationship to the aquatic eco-system.

It is hoped that the final outcome of this study (available by mid 1973) will be the ability to determine (through scientific analysis of data) such practical information as:

1. The number of cottages a lakeshore can withstand;
2. The relative location of cottages;
3. The recommended sanitary disposal systems;
4. The number and kind of recreational activities permitted on the lake;
5. The number (if any) of motor boats allowed;
6. The location of marinas and their size;

7. The amount of recreational land activities within the watershed (skiing, snowmobiling, all-terrain vehicles, etc.).

We can see this study as being a great contribution to the fight against the misuse of our environment, as long as the Department of Municipal Affairs enforces the application of the above constraints, recognizing that the maximum dollar profit is no longer the top priority - but the quality of our environment is.

The logical and much needed outcome of studies such as this will be a reconsideration of the design of man-made environments. For example, new legislation to ensure that a minimum number of trees be retained on a site will require that construction methods be carefully reconsidered. If the trees are indiscriminately cut and the land scarred by bulldozers in the process of construction, then the purpose of studies such as the above will be defeated since trees and soil are an integral part of the lake, lakeshore microclimate and ecosystem.

Small scale studies of the recreational capabilities of a given lake have been done before, but not with as much scope and depth as the Lakeshore Parameters Study. One such study, the "Riley Lake Project", was prepared by Hough and Stansbury Assoc. for the Department of Municipal Affairs. It recommended at what point development should be stopped due to excessive pollution, but was not able to assess the maximum allowable number of cottages and motor boats for that site, as the Lakeshore Parameters Study is attempting.

The next step for the Department of Municipal Affairs would be to initiate a study to develop methods of rehabilitation for over-populated and over-used land and water resources.

Multiplicity of use of a recreation area can be an ideal way to conserve land, but activities must be compatible. Areas for very light use in terms of activities, such as camping close to nature, must be isolated for both psychological and ecological reasons from automobile access, parking, restaurants, etc. which both infringe on the solitude of wilderness areas as well as destroy their ecological balance.

Lack of understanding for the demands of the land and the requirements of people has led to many costly mistakes. For example, areas of Yellowstone Park in the United States, especially near the geyser "Old Faithful" have suffered soil damage due to compaction to such an extent that vegetation may be retarded for the next 25 years. These areas may have to be closed to the public to rehabilitate them. This shows the vital need to understand the needs of the land; where should (or should not) heavy recreational use be located. The results of such studies will have to be legislated and implemented to control the quality of planning, development and use which influence the most valuable asset we have, our natural environment.

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PART THREE
URBAN LANDSCAPE

THE END
OF THE WORLD

CHAPTER SEVEN

URBAN OPEN SPACE AND RECREATION

tom gunton

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INTRODUCTION

This report deals with aspects of urban open space. It is not an attempt to provide a comprehensive open space plan for the study area; rather, it is intended as a critique of present facilities and policies of open space planning, combined with suggestions and recommendations. It deals predominantly with the origins and neglected aspects of current open space programs. Case studies are included in the report to attempt to relate the points to specific physical areas and to evaluate existing and planned open space systems.

School sites have not been dealt with due to limitations in time. Where evaluations of park systems are made, the standards imply that the parks system is already supplemented by school playgrounds and recreational areas. Also for the purposes of this report, conservation areas have been excluded from urban statistics, but are included in the rural classification.

Throughout this report the term "open space" will refer to land under municipal, private or provincial control intended for the collective recreational use of the public.

FUNCTIONS OF OPEN SPACE

Adequate open space in crowded urban centres is a necessity. It relates to the quality of life. Urban sprawl, increased leisure time, increased living density and decreasing amounts of private open space such as backyards, makes this more acute.

Open space can be a planning tool to contain urban sprawl. An example of this type of planning is the attempt by British planners to limit the overspill of London. By 1959, a green belt of 840 square miles surrounding London was established. The Minister of Housing and Local Government stated the purpose to be: a) to check further growth of urban areas, b) to prevent neighbouring towns from merging and c) to preserve the special character of towns.

However, the growth of London was not halted. By leap-frogging over the green belts it was able to continue. The speculative pressures and the need of land for housing forced encroachment upon these areas.

Recently, studies have begun to indicate a relationship between green open space and psychological health. One theory by Sapora and Mitchell in 1961¹ states that leisure activities are sought for relief of the tension and frustration of daily activities. Experiments by D. Bishop and P. Witt tend to verify this theory. They found that in cases of frustration and tension, people often sought recreational activities for relief.² A study of *old age people* concluded that those taking part in leisure activities were 15% less likely to visit a psychiatrist.³ Lady Allen of Huntwood notes that with the increased availability of recreational opportunities, the incidence of local juvenile crime decreases.⁴

¹ Sapora and Mitchell, *Theory of Play and Recreation*.

² D. Bishop and P. Witt, "Situational Antecedents to Leisure Activity", *Journal of Leisure Research*: 2, 1970.

³ Seymour, *Small Urban Spaces*, (New York: University Press, 1970).

⁴ Lady Allen of Huntwood, "Adventure Playgrounds", *Small Urban Spaces*.

A direct result of recreational facilities on physical health has been demonstrated. Work by the Ontario Heart Foundation has proved the statistical relationship between physical activity and heart attacks. One of the recommended treatments of heart attacks emphasizes the need for walking and other related activities. Other studies show that those who exercise regularly are 50% less likely to visit physicians.¹

Open space also has a biological function. Grass and other foliage absorb air pollutants such as lead and sulphur dioxide and also give off oxygen which improves air quality. Plants also humidify the air and cool it. Studies indicate a significant temperature difference between areas with much concrete and asphalt and areas covered with vegetation.²

OPEN SPACE STANDARDS

The most commonly accepted standard for park space is 10 acres/1000 population in the city, 15 acres/1000 in the suburbs and 65 acres/1000 in provincial parks.³ The National Recreation and Park Association in the U.S., which uses these standards as a guide, is frank in stating that they were set many years ago by some forgotten person. Other standards deal with different types of recreational facilities. The American Bureau of Outdoor Recreation states that for 50,000 people, there should be: 1) 25 miles of hiking trails, 2) 25 miles of cycling trails, and 3) 5 miles of horseback trails. Hamilton has devised its own set of standards (see below). Proposed standards for Hamilton are also included along with optimum distances from the parks and optimum sizes.

¹ Seymour, *Small Urban Spaces*, p. 9.

² Interview with Mr. Adedee, Department of Horticulture, University of Guelph.

³ The standard of 10 acres per 1,000 is also endorsed by the Ontario Department of Education.

SCALE OF PARK	EXISTING STANDARDS	PROPOSED STANDARDS	distance (miles)	size (acres)
	acres/1000	acres/1000		
Neighbourhood	1	2.5	$\frac{1}{4}$ - $\frac{1}{2}$	5-7
Community	1	2	$1\frac{1}{2}$	20-30
District	1.1	1.5	1-2	40
City-Wide	3.5	5		100

Burlington does not possess any official standards.

The proximity of an open space area determines its actual value. Ten acres/1000 population of open space is virtually useless if the parks are not located near the people. This is especially true for young people. Studies reveal that 5-13 year olds will usually travel distances of only 300 to 400 yards.¹

The aspects of accessibility have been aptly dealt with in the City of Hamilton's Open Space Report. Hopefully, the suggestions will be implemented.

Attitudes toward growth and bigness have been manifested in an approach towards parks, emphasizing large blocks of land. But in terms of the greatest value of park facilities, psychological aspects must be considered. The failure of many large parks has been influenced by their physical make-up. Those parks lacking diversity of landscape and facilities are used minimally.¹ Because individuals seek out open space with different needs and desires, this diversity in

¹ See last page for reference.

motivation must be dealt with by a diversity in physical layout. Many parks in the Hamilton-Burlington vicinity neglect this need.

Parks which are successful possess centres around which activities can revolve, such as swimming pools, band shells, or some other form of social amusement.

Playgrounds

Again, the significance of playgrounds increases when one considers the need for offering an exciting alternative to roadways, railway tracks, etc. A study by A. Miller and J. Cook concludes that playgrounds must compete with these other environments.¹ Serious accidents have occurred because children sought out dangerous areas to relieve their boredom, rather than existing facilities.

Suggested characteristics of stimulating playgrounds with increased recreational utility include:

1. Location - Playgrounds must be within at least 1/8 mile, preferably on each block. Access, isolated from traffic arteries, must be provided. A study of 350 children under seven demonstrated that not one could comprehend traffic rules.
2. Nature of Playground - Playgrounds entertaining the "adventure concept" seem to be the only ones able to compete with other environments (e.g. railway yards). Sand or dirt piles, a supply of wood with holes for nuts and bolts, ropes, and other materials which can be utilized in different ways according to children's desires, offer a degree of stimulation which can compete with the dangerous environments. School sites are ideal for this type of facility.

British Columbia is providing this type of playground. In England, nothing more serious than cuts and bruises have been incurred from their use.

¹ A. Miller and J. Cook, Pedestrians and Vehicles on Housing Estates".

Failure of Standards to Adjust to Social Trends

In the past decade the trend towards apartment living has been significant. A look at the past combined with future projections demonstrates this:*

	Year	Houses as % of Dwelling Units	Apartments as % of Dwelling Units
Past	1960	78.8	16.8
	1962	76.9	18.5
	1964	73.7	21.8
	1966	69.5	25.8
	1968	67.6	27.7
	1970		29.0

Future Projections	1976	65.2	34.8
	1981	61.1	38.9
	1986	56.7	43.3
	1991	52.8	47.2
	1996	49.0	47.2
	2000	46.4	53.6

Planners of open space standards have generally ignored this phenomenon by refusing to differentiate between high rise and multiple unit dwellers and single residential dwellers.

An attempt has been made via zoning regulations to compensate for the increased open space needs of apartment or multiple-unit dwellers. For example, in Hamilton 25% of any project must be landscaped. An incentive system is provided to persuade developers to provide even more. Nothing is stated about the location or quality of the space that the developer must provide.

Burlington also requires that 25% of the area be landscaped for open space purposes. In addition, it is required that a playground be provided of 50 sq. ft. for each unit, or 1000 sq. ft., all together, whichever comes first. But as

* Source: Hamilton Planning Department.

the zone increases in density, this amenity area decreases in size. For example, in Burlington in an RM5 category (allowing 75 units per acre) 400 sq. ft. of amenity space must be provided for each unit, but in an RM6 zone (allowing 100 units per acre) this has dropped to 250 sq. ft. per unit. For a comprehensive description of these regulations one should look at the zoning by-laws.

Surveys have demonstrated that residents of high density dwellings are dissatisfied with the recreational facilities provided. For example, a study undertaken by Michelson, a sociologist at the University of Toronto, indicates:

1. that there are a number of activities which require private or semi-private open space facilities. Yet 65% of the respondents of the survey did not possess any personal open space.
2. that those who moved did so primarily because of lack of private open space.
3. that 50% of the respondents had social and physical recreational desires which could not be satisfied because of limitations in the physical environment.¹

Other surveys have shown that 95% of the residents of a town-house development in Burlington were dissatisfied with the open space facilities.² A study of highrise dwellers in Hamilton showed that a high percentage were dissatisfied with the facilities.³ Lady Allen concluded that 72% of those children forced to live above the third storey have no opportunities for normal playground activities.⁴

¹ Michelson and Diamond, p. 19.

² Burlington YMCA, *Burloak Low Income Housing*

³ Hamilton YMCA, *Social and Recreational Needs of High Rise Dwellers*.

⁴ Michelson and Diamond, p. 40.

Michelson and Diamond propose that to compensate for the increased needs of multiple-unit dwellers, the following would be required:

1. An outside private space for each unit equal to the floor area, less the bedroom;
2. For 30-75 families, a 150' x 150' collective recreational area;
3. For children, a play area 50' x 50'.

If these requirements are related to the zoning regulations in Hamilton and Burlington a rather impossible situation arises. For example, in a zoning category allowing 100 units/acre, the following open space requirements should be met:

- a) at a standard of 400 sq. ft. of open space/unit:
 required: 400 x 100 = 40,000 sq. ft.
- b) 150 ft. x 150 ft. shared open space facilities:
 required: 150 x 150 = 22,500 sq. ft.
- c) children's play area 50 ft. x 50 ft :
 required: 50 x 50 = 2,500 sq. ft.

Total required open space for project 65,000

However, there are only 43,560 square feet in an acre. Moreover, this does not take into account other recreational facilities required. In addition, at 10 acres/1000 population, another 2.4 acres of open space should be required at 2.4 people/unit.

Even in Burlington, in RM4 zoning of 50 units/acre, the same situation exists.

PLANNING FOR OPEN SPACE NEEDS

Both Burlington and Hamilton are employing past usage patterns to determine future recreational needs. A number of inadequacies are inherent in this approach: past usage figures do not deal with social trends such as increased leisure time or apartment living. For example, if increased leisure time comes in the form of longer vacations, demand will be put on the provincial parks. On the other hand, if increased leisure time comes in the form of a 4-day week, the potential for leaving the city to enjoy the leisure time will be minimized, and the demand will be put on facilities within or close to the city. If leisure time is obtained through shorter working days, the demand will be felt predominantly on neighbourhood parks.

Usage figures also ignore psychological usage of park facilities. One may never physically go into Spencer Smith Park in Burlington but may obtain just as much enjoyment from seeing it, or even by perceiving its existence (the ability to use if so desired). The psychological security obtained from areas as an alternative to masses of concrete and asphalt is quite significant and may be one of the major types of park usage.

Also ignored is the cyclical nature of facilities and their usage. Usage actually increases with the supply; the facilities have to be provided before they are consumed. For example, one may study past performance of a swimming pool and conclude that it was rarely over-crowded. Therefore, the construction of another pool may be postponed. But the increased availability of pools would probably increase the usage due to increased accessibility and because many potential pool users refrained from using the last pool due to

the general dislike of crowded pool conditions.¹

FINANCING OF OPEN SPACE

Both Burlington and Hamilton have in the past acquired open space through three means:

1. through the finances made available from the 5% dedication fee for each development.
2. through finances made available from the sales of other parks.
3. through donations from members of the community.

The 5% dedication is the main source of finances for such acquisition. Included in the Planning Act, it states that a developer either has to provide 5% of his development for open space or the cash value of 5% of his land. However, if the cash is obtained, it does not have to be spent for parks.

The problem with the 5% dedication fee is that it is based on land as opposed to population density. For example, a recent project in Burlington on an RM4 zone (50 units/acre) was to house approximately 388 people on 2.9 acres of land. At 10 acres/1000 the required open space for the residents would have been 3.9 acres. But the 5% dedication fee would have provided only .15 acres.

The policy of the municipality is usually to purchase parkland in areas with cheaper land values. This tends to create parks where people are not, thus minimizing park utility.

¹ For more details see Chapter Six, *Are We Ready*, page 151.

LINKAGES OR GREEN BELT CONNECTIONS

Linkage or green belt connections have a distinct advantage over the traditional square park. This does not negate the need for traditional parks, but merely suggests a required addition to them.

It is felt by many open space planners that the use of a park facility is related to the perimeter of the park. A larger perimeter by increasing the contact area between the park and people increases the potential for psychological as well as physical usage. People base their perception of park size on the perimeter, and can be made to feel that parks are much larger than they really are.

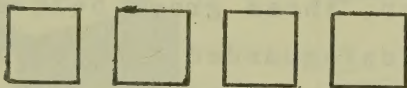
For example: laying out of 4 square miles of park could take on a number of faces.

1.



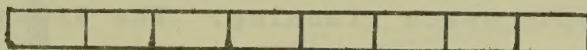
Laid out in this form, it would equal 8 miles of perimeter.

2.



In this form, it would provide 16 miles of perimeter.

3.



In this form, it would provide 18 miles of perimeter.

Linkages, as opposed to blocks, provide ideal settings for walking with maximum pleasure through relief from roads and vehicles. In the Burlington-Hamilton area, one of the

greatest complaints in terms of park facilities is the lack of areas to walk. Linkages also increase the safety factor by acting as transportation routes. Children use them when travelling to other park facilities or to school, thus minimizing their contact with motor vehicles.

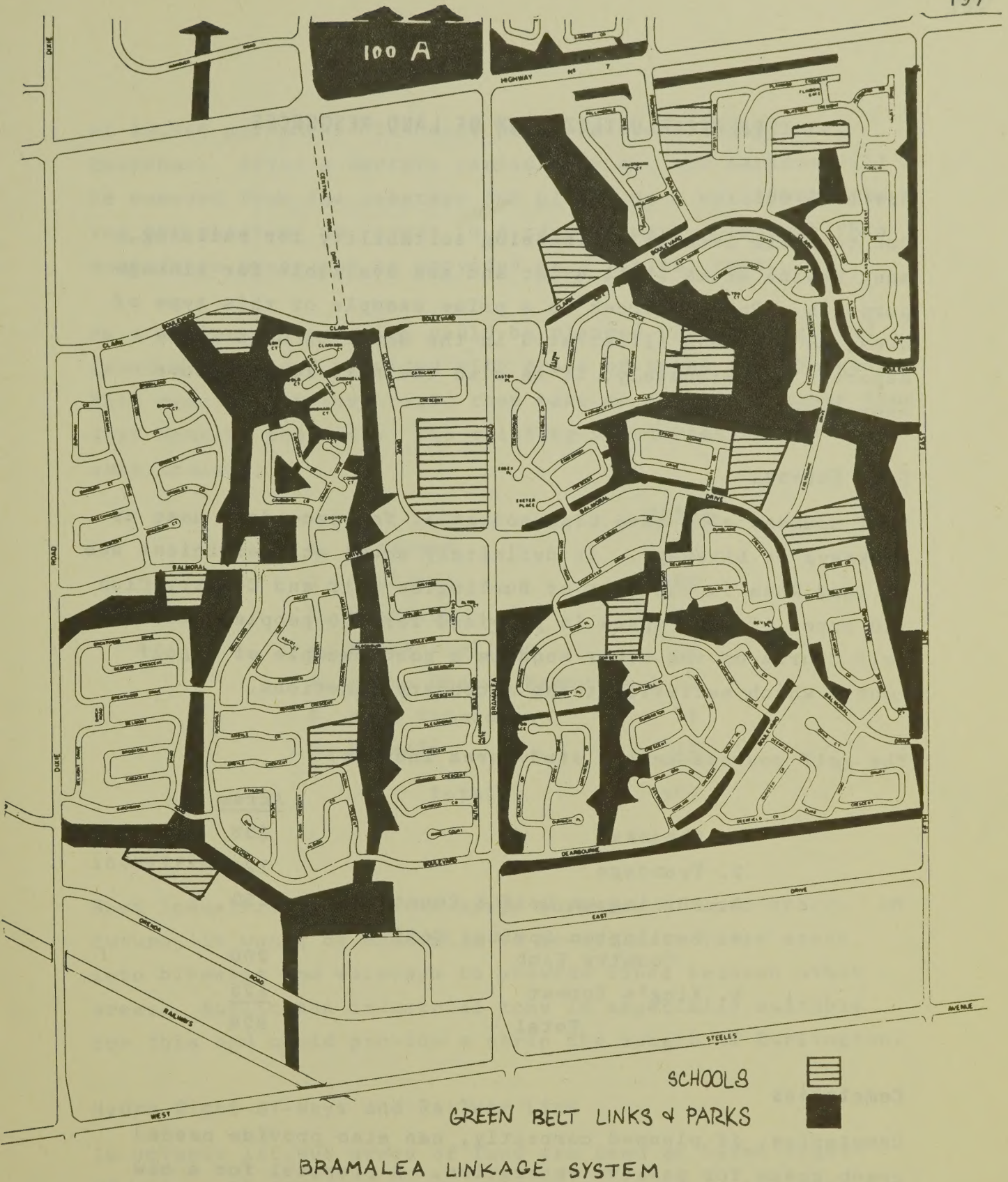
The green space system for Hamilton included a recommendation for park linkages. However, the recommendation was turned down due to two traditional arguments:

1. Linkage systems will be havens for criminal activity.
2. Workmen with existing equipment would find it difficult to maintain these areas.

Bramalea which is the only place in Ontario to have implemented a link system may help to dispell these myths. A look at the Bramalea map demonstrates the value of the linkages as transportation routes to schools and other parks, thus minimizing contact with traffic (see page 197).

The Bramalea Police Department has stated that relatively few traffic accidents between children and cars have occurred. That their utility as walkways insulates the pedestrians from the noise and pollution of the automobile is also demonstrated by the map. Further, these green belt systems by following creek beds, have safeguarded some of the natural amenities from obliteration and helped in flood control.

All agencies and members of the community have approved of this approach to open space planning. The Bramalea Police Department has had no complaints related to deviants or criminals using the links and the Parks and Recreation Department has had no increased difficulty maintaining these areas as compared to traditional parks.



EFFECTIVE UTILIZATION OF LAND RESOURCES

Ravine Areas

Due to their lack of engineering suitability for building, many ravine areas still exist and are available for linkage purposes. Redhill Creek is a prime example of this type of area, as has been illustrated in the Hamilton Open Space Report. Unfortunately, it is also the site for a future expressway.

Golf Courses

Golf courses also have high potential for secondary uses as walkways or bikeways. It definitely seems an inefficient use of land when in the case of Burlington Golf and Country Club 150 acres of open space is provided for 700 people. Chedoke Golf Course on the other hand is a good example of a golf course which satisfies these secondary functions.

The golf courses in the study area include:

	<u>Acres</u>
1. Chedoke	233
2. Tyandaga	120
3. Burlington Golf & Country Club	150
4. Burlington Springs Golf & Country Club	200
5. King's Forest	<u>125</u>
Total	828

Cemeteries

Cemeteries, if planned correctly, can also provide needed green space for passive recreation. A proposal for a new cemetery in Burlington (near Walker's Line and No. 1 Side Road) demonstrates this. 50 acres of land are being purchased

at \$3,000 per acre. The cost would be absorbed by local churches. After a certain period of time, the markers will be removed from the cemetery and placed on a wall thus allowing the cemetery to revert to a passive park. Through this means open space can be provided at a minimal cost.

As a minimum, cemeteries could be planned with flat ground level markers and provided with areas of trees and benches. This type of cemetery could then take on functions other than just housing the dead. The existing cemeteries in the study area include:

	<u>Acres</u>
1. Woodland	100
2. Hamilton	100
3. Eastlawn	50
4. Mount Hamilton	100
5. White Chapel Memorial	22
6. Holy Sepulchre	75
7. Francis	<u>20</u>
Total	467

Industries

Most industrial zones have large acreages of open space. In future, it would be desirable to co-ordinate these areas into bikeways and walkways to provide links between other areas. Burlington industrial zone is especially suitable for this and could provide a strip the length of Burlington.

Hydro Right-of-Ways and Railway Line

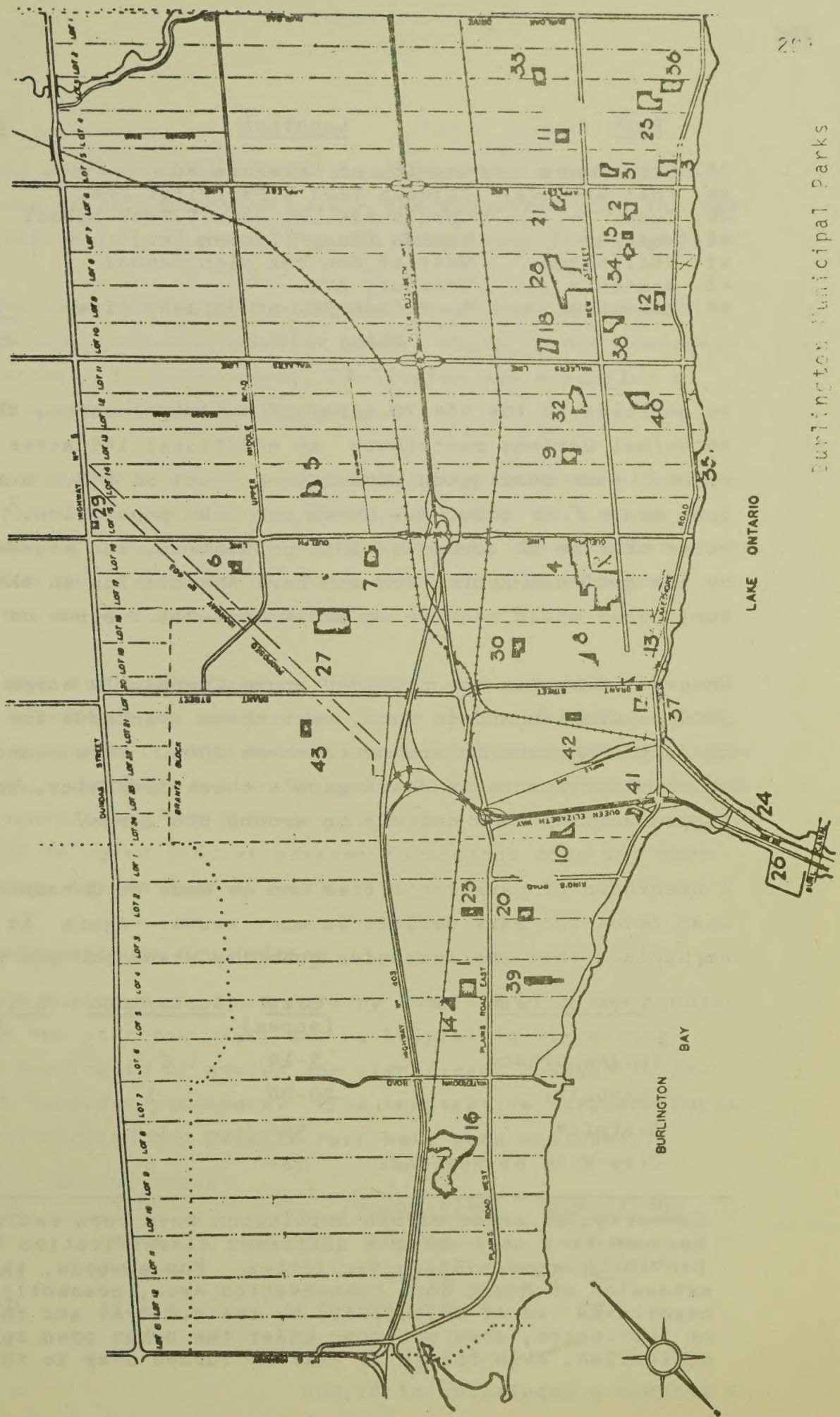
In Ontario 115,000 acres of land are used as hydro right-of-ways. 50,000 more acres will be acquired in the next 5 years. Hydro right-of-ways would be ideal for walkways,

bikeways and snowmobiling.

BURLINGTON'S OPEN SPACE FACILITIES

As of June 1971 Burlington had 454.73 acres of municipal parks.

<u>Park</u>	<u>Location</u>	<u>Acres</u>
1. Aldershot	Gallagher Rd. at Plumtree Dr.	8.83
2. Breckon	Spruce Ave. and Tuck Dr.	4.05
3. Bromley	Maureen Ct. at Bromley Rd.	5.80
4. Central	New St. at Delaware Ave.	50.85
5. Centennial	Centennial Drive	5.00
6. Champlain	Guelph Line at Mountain Grove	3.80
7. Clarksdale	Mountainside Dr. at Nottingham	5.00
8. Coronation	Emerald St. and Wellington Ave.	.60
9. Cumberland	Cumberland Ave.	4.51
10. Earl Court	Shepherd Dr. at Francis Rd.	3.00
11. Frontenac	Wedgewood Dr. at Parkside Cres.	3.32
12. Glen Afton	Belvenia Rd. at Corrine Crt.	4.82
13. Gore	Gore St. and Lakeshore Rd.	.12
14. Grove	Gallagher Rd. and Grove Pk. Dr.	2.75
15. Henderson	Henderson Rd. and Spruce Ave.	1.30
16. Hidden Valley	Hidden Valley Road	51.75
17. Hydro	Brant St. at Elgin St.	.40
18. Iroquois	Wilene Drive	5.50
19. Kilbride	Panton St.	18.47
20. Kiwanis	Townsend Ave. E. at Sanford Dr.	4.40
21. Longmoor	Longmoor Drive	5.30
22. Lowville	Guelph Line	92.60
23. Maplehurst	Mary St. at Maplehurst Drive	2.00
24. McDonald	Lakeshore Rd. (Beach Strip)	.68
25. Mohawk	Spruce Ave. at Kenwood Ave.	7.30
26. Morris	Lakeshore Rd. (Beach Strip)	.53
27. Mountainside	Mt. Forest Dr. at Dunbar Rd.	29.00
28. Nelson	New St. at Shoreacres Rd.	42.86
29. Nelson Hall	Guelph Line at Dundas St.	1.00
30. Optimist	Prospect St. Near Pearson St.	7.20
31. Pineland	Appleby Line at Fern Drive	2.69
32. Ryerson	Woodview Rd. No. or HEPC Line	6.99
33. Sheldon	Pineland Ave. at Riverside Dr.	5.01
34. Shore Acres	Spruce Ave. near Wilson Ave.	2.30
35. Sioux Lookout	Lakeshore Rd. near Wilton Ave.	.70
36. Skyway	Kenwood Ave. (near Skyway Plaza)	8.49
37. Spencer Smith	Lakefront (Brant to Brock)	13.00



<u>Park</u>	<u>Location</u>	<u>Acres</u>
38. Strathcona	New St. at Belvenia Rd.	4.40
39. Teal Greenway	Between Teal & Partridge Drs.	4.50
40. Tuck	Spruce Ave. at John T. Tuck School	8.90
41. Wardley	Oneida Place (Indian Pt.)	1.60
42. Wellington	West of Central High School	3.00
43. Westbury	Westbury Ave.	4.00
44. Zimmerman	No 2 Side Rd. at Appleby Line	<u>16.41</u>
Total		454.73

In addition to the 454.73 acres of municipal parks, the Royal Botanical Gardens contribute an additional 145 acres of open space. Thus Burlington possesses a total of 599.9 acres of open space,¹ or about 7.4 acres per 1000 population.² To raise this to 10 acres per 1000 population, the standard adopted by the National Recreation and Park Association in the U.S.A., Burlington would require an additional 211.1 acres of park land.

However, Bramalea has provided approximately 12 acres of park/1000 population and in fact, open space standards for suburbs state the optimum is around 15 acres/1000. This standard, which relates more to Burlington's characteristics, would increase Burlington's deficit to around 615 acres.

A breakdown of park facilities can be made to determine at what level the park deficit is most acute. Again it must be emphasized that the following quantity standards are minimal:

<u>Type of Park</u>	<u>Size</u> (acres)	<u>Acres/1000</u>	<u>Accessibility</u> (miles)
Neighbourhood	5-10	2.5	$\frac{1}{4}$
Community	20-30	1	1-1 $\frac{1}{2}$
District	40	1.5	1-2
City-Wide or Regional	75+	5	-

¹ Conservation areas within Burlington have been excluded because they come under a different classification i.e. provincial conservation facilities. For example, the 226 acre extension of Mount Nemo Conservation Area, presently being negotiated (as of July, 1972) by the H.R.C.A. and the Town of Burlington, does not come under the urban open space classification, even though it will be turned over to the Town.

² assumes a population of 81,000

Using the preceeding standards Burlington has a deficit of 25.5 acres of neighbourhood park. The suggested plan for East Burlington would compensate for the deficiency (see page 209).

Using the same standards Burlington should have about 202 acres of community and district parks, while it now possesses 231.28 acres. In other words, Burlington has a surplus of about 29 acres in this category.

For city-wide or regional park, Burlington requires 405 acres. It now possesses 237.6 acres (Lowville Park - 92.6 acres and the Royal Botanical Gardens - 145.0 acres). Or in other words, Burlington has a deficit of 167.4 acres in this category, equivalent to two large scale parks.

In summary, Burlington's main thrust in the area already urbanized should be to acquire two large regional parks. However an adequate linkage system would substitute for the deficit in this category and would probably be a more viable alternative considering the post-development status of the area. It should be noted that at present Burlington does not have any linkage (green belt system).

Past Performance in Acquisition

A look at Burlington's park history combined with the population for the past ten years may be helpful in discerning whether Burlington is making any significant changes in its approach towards open space. (For comparative purposes Royal Botanical Gardens and LaSalle Park have been excluded.)

<u>Year</u>	<u>No. of Acres of Park</u>	<u>Population</u>	<u>Acres/1000</u>
1960	177.4	44,709	3.9
1962	194.88	48,024	4.1
1964	302.42	54,997	5.5

<u>Year</u>	<u>No. of Acres of Park</u>	<u>Population</u>	<u>Acres/1000</u>
1966	310.34	65,453	4.8
1968	361.70	76,075	4.8
1970	398.47	82,620	4.8

It is evident that Burlington has not improved its position as related to parks. When we consider the social changes of the past 10 years, especially the trends toward increased leisure time and more apartments, we should admit that the situation has deteriorated.

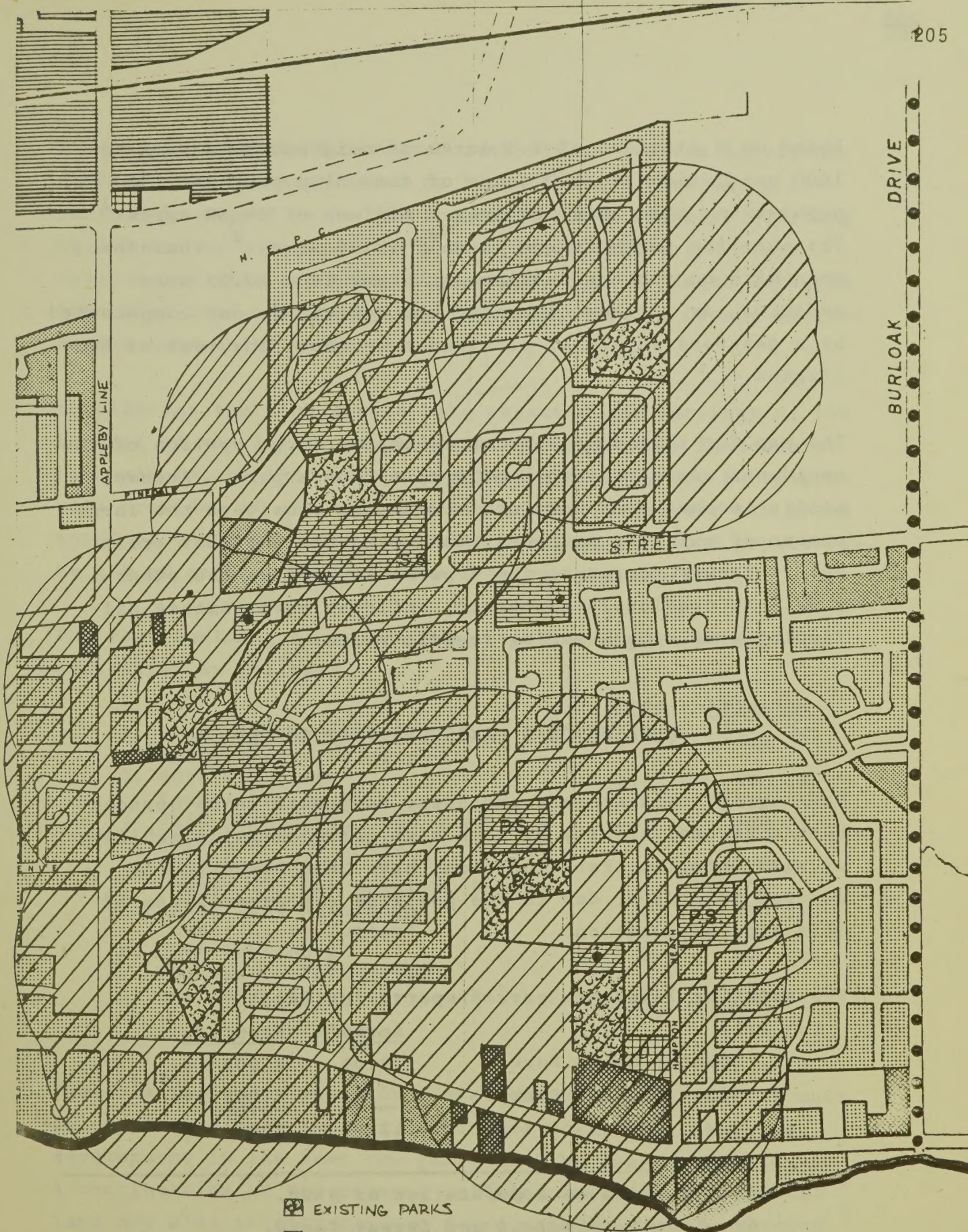
A Case Study

A more comprehensive understanding of the inadequacies of Burlington's green space system can be achieved by a careful examination of a typical developed area.¹

The area chosen for study is encompassed by Burloak Drive, New St., Appleby Line and the Lake (see map). It contains several highrises and undeveloped land zoned for highrises. Hence, the population can be expected to increase significantly during the next few years. But the park acreage in the area will from all indications remain static.

It must be emphasized again that the standards employed in this area were developed prior to the highrise living trend and do not take into account the increased needs of high-rise dwellers. In other words, they are based upon the traditional assumption that residents have access to some open space from their own dwelling.

¹ Because of limitations in space, this approach is not applied to Burlington in total but the conclusions would be adaptable to most sections.



EXISTING PARKS

AREA WITHIN QUARTER MILE RADIUS

CASE STUDY OF EXISTING URBAN AREA

Based on a standard of 2.5 acres of neighbourhood park per 1000 population and 1.0 acres of community park per 1000 population, this area requires a minimum of 34.30 acres.¹ The existing park acreage is only 24.28 acres.² Therefore, even with no further development there is a 10.02 acre deficit. As already discussed the deficit is not compensated by a generous supply of parkland throughout the rest of Burlington.

The map for this area also shows that a large portion of the residents are more than $\frac{1}{4}$ of a mile from a park. Accessibility becomes even more acute when one considers the large number of existing and potential residents who must cross No. 2 Highway to get to the 4 parks located on the other side. As previously discussed, children have immense difficulties in comprehending traffic rules.

BURLINGTON'S LAKESHORE PARK SYSTEM

Burlington residents are extremely fortunate to be bounded with a natural amenity of such high recreational capability as Lake Ontario. Park locations have been consistently desired near water due to the positive characteristics of this type of location.

The existing lakeshore park property included:

	<u>Acres</u>	<u>Frontage</u>
1. Spencer Smith Park	13.00	2,000 ft.
2. Sioux Lookout Park	<u>.70</u>	<u>603 ft.</u>
Total	13.70	2,603 ft.

¹ Calculation based on a population of 9800.

² Bromley, Mohawk, Pineland and Skyway Parks.

The approach of the Burlington authorities towards lakefront parkland may be exemplified by Sioux Lookout Park where the philosophy seemed to be "if you can't put a highrise building on it, put up a sign, throw a few picnic tables and trash cans on the site and call it a park." Spencer Smith Park, on the other hand, may never have been acquired if Canada did not have a centennial celebration.

Considering the high growth rate expected for Burlington, the acreage of the lakefront parks system is grossly inadequate. For example, by 1980 with a population of 151,000, Burlington will provide, if additional acres are not acquired, the grand total of 0.081 acres of lakefront parkland per 1000 population, or 1/5 of an inch of lakeshore frontage per capita.

The few remaining lakeshore properties with park potentials are listed as follows:

	<u>Acres</u>	<u>Frontage</u>
1. 2256 Lakeshore Hwy. (owner Spags Holdings)	2.7	309 ft.
2. 3084 Lakeshore (owners D. Morinis)	2.9	300 ft.
3. 4254 Lakeshore, lots 3,4,5 & 6 (owner D. McNichol)	8.1	200 ft.
4. 5250 Lakeshore (owner Top Hat Motel-D. Bolus)	3.06	384 ft.
5. 5250, 5292 Lakeshore (owner C. D. Tutton)	2.3	300 ft.
6. 5394 Lakeshore (Lakeshore Park Motel)	5.1	650 ft.
7. Lot adjacent to Spencer Smith Pk.	<u>2.5</u>	<u>200</u> ft.
Total	27.1	2343 ft.

There is then some remaining lakefront property. But it must be emphasized that the decisions made regarding lakeshore development in the next few years will be non-reversible. A continuation of the present policies toward lakeshore land use will shortly consume every remaining piece of potential parkland.

Burlington Town Council has consistently balked at the idea of acquiring anymore lakefront property along No. 2 Highway due to the high costs (approximately \$50 - 70,000 per acre). Burlington Town Council used the same argument when the 2.9 acres of the old Convalescent Home (3084 Lakeshore) was offered to them for about \$30,000. Recently this land was valued at around \$180,000. Obviously, the longer the delay the more expensive the land gets. In fact, in the lake-shore area from White Pines Drive to Burloak the Town council has increased land prices itself by changing the zoning to allow multiple units, thereby raising the speculative value.

Financial aid is desperately required if potential lakefront parks are to be obtained. Aid from the provincial government would be especially appreciated considering the province-wide appeal of accessibility to Lake Ontario. It would be appreciated too if Burlington Town Council approached the lakefront land with the same zeal as it approached Tyandaga Golf Course (offering \$600,000 for purchase) which is zoned open space anyway. Instead Burlington Town Council argues that it is getting more acres for its money by acquiring Tyandaga Golf Course, completely neglecting the qualitative advantages of parkland on Lake Ontario.

It seems ironic that government authorities are spending large sums of the taxpayers money to clean up Lake Ontario, yet the fact that the taxpayer can't easily use the lake as a recreational facility because he has limited access to its shores is ignored.

SUGGESTED PLAN FOR LAKEFRONT AND EAST BURLINGTON PARK SYSTEM

Potential still exists for modifying the open space system in Burlington. A network of the few remaining pieces of lakefront property and hydro right-of-ways could create an extensive system of connected green belt (see map).

The lakefront properties suggested for acquisition would require the greatest expenditures. The rest could be acquired relatively inexpensively. The same approach could also be applied to the rest of Burlington.

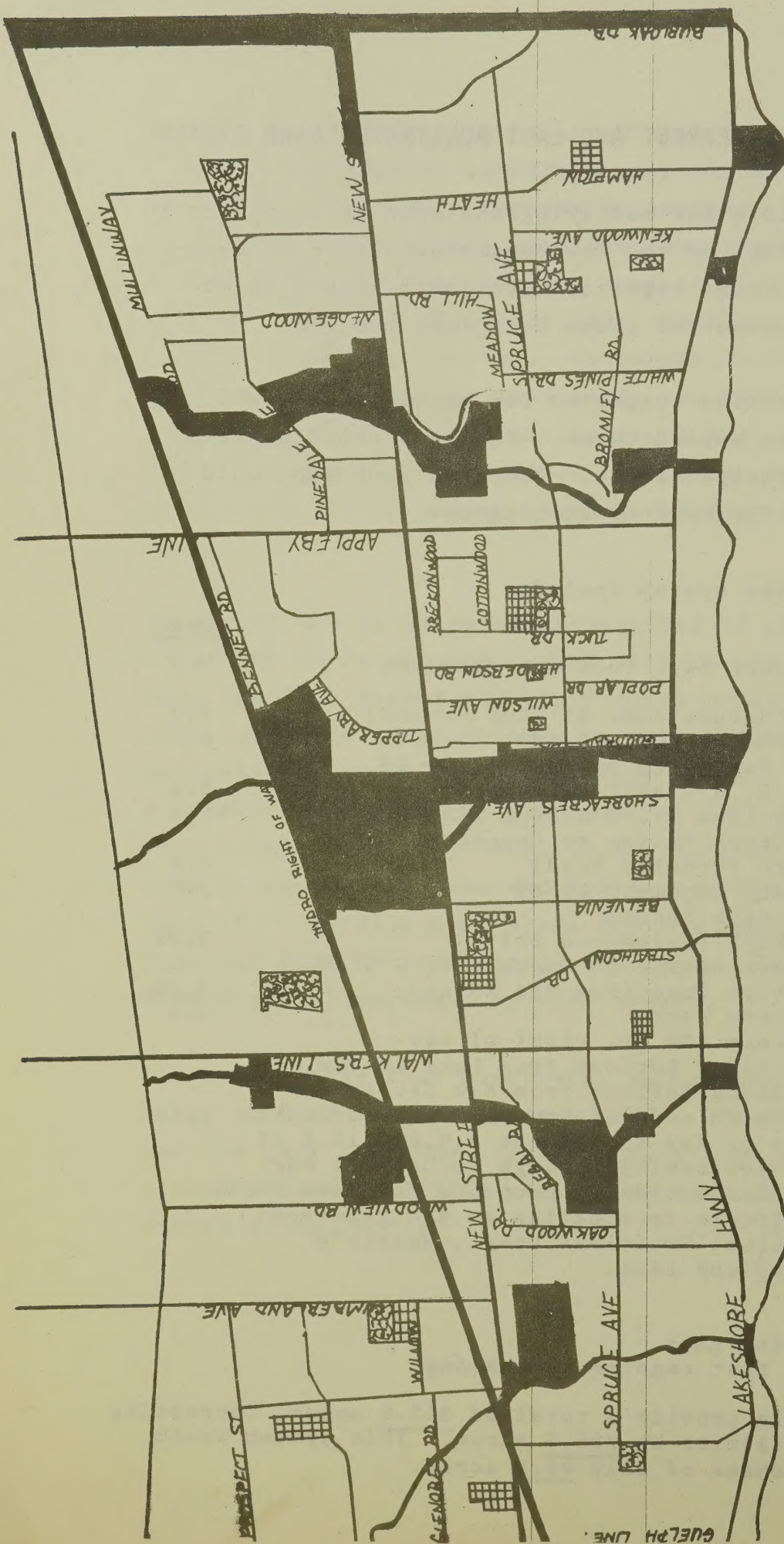
The components of the system include:

	<u>Acres</u>
+ 1. 3084 Lakeshore Hwy. (old Convalescent Home)	2.9
* 2. Tuck Park (Spruce Ave. at Tuck School)	8.9
* 3. Ryerson Park (Woodview Road)	6.9
4. Tuck Creek Ravine to connect 1, 2, & 3.	
+ 5. Lots 3, 4, 5, 6 - 4252 Lakeshore	8.1
* 6. Nelson Park (New St. & Nelson High School)	42.8
+ 7. Shoracres Creek Ravine to Connect 5 & 6	
* 8. Bromley Park (Bromley Road)	5.8
* 9. Pineland Park (Appleby Line)	2.6
* 10. Lord Elgin High School	
* 11. Frontenac Park (Wedgewood Drive)	3.32
12. Appleby Creek Ravine to Connect 8, 9 & 10	
+ 13. 5250 Lakeshore Road (Top Hat Motel)	3.06
+ 14. 5394 Lakeshore Park	5.1
15. Shell Refinery 500 ft. right of way (East side along Burloak from Lake to QEW West side along Burloak from New St. to QEW Along the north side of New St. from Burloak)	
16. Hydro Right of Way to connect 3,4,6,7,15 & 17	
17. Connection proceeding through Industrial Park located on South side of proposed Fairview Park.	
18. Dead end streets terminating at the lakefront at Guelph Line, Fruitland Cres., Walker's Line and Appleby Line.	

* indicates existing park

+ indicates lands that require purchasing

This system would provide a total of 363.9 acres, increasing the present facilities by 285.3 acres. This system would require the purchase of only 48.5 acres.



-  SCHOOLS
-  PARK/LINK COMPONENTS
-  EXISTING PARKS

OVERALL CONCEPT : EAST BURLINGTON LAKESHORE PLAN

The plan provides a high degree of accessibility to both the waterfront and to schools. The use of these linkages for transportation and passive recreation is especially desirable considering the need for increased waterfront accessibility and for walking areas isolated from the noise and pollution of roadways.

Because many of these potential park areas are planned sites for future development, immediate acquisition is required. Otherwise these areas will quickly disappear. (More details of this plan are available from the Hamilton Federation of Environmental Groups).

OPEN SPACE PLAN FOR POTENTIAL URBAN AREAS

In examining Burlington's open space system attention should be given to future developments. Brant Hill provides a good example of what can be done. Of course, the design for the area is not final. But tentatively the breakdown for land use is as follows:

	<u>Acres</u>
1. Open Space	196.7
(Toronto Central Region Parkway -	
98.4 acres, Greenway (passive) -	
25.6 acres, neighbourhood (passive) -	
36.8 acres, neighbourhood (active) -	
19.5 acres, and community (active) -	
16.4 acres)	
2. Residential	380.2
3. Commercial	21.2
4. Education	51.2
5. Roads	80.7
(Highway 403 - 50.0 acres,	
Other 30.7 acres)	
Total	<u>730.0</u>

The population of Brant Hill will be in the range of 14,000 people. Thus the development will provide approximately 14 acres of open space/1000 population. The plan also includes a green belt or link system similar to the one implemented in Bramalea (see page 197) with a large community park in the centre and open space connections to the schools. The Toronto Centred Region Parkway adds significantly to the open space facilities as the land use breakdown indicates.

Hence, it appears that Burlington's plans for open space facilities in this instance relate to the needs of the residents. This should be applauded. Brant Hills, however, is not totally representative of future Burlington developments.

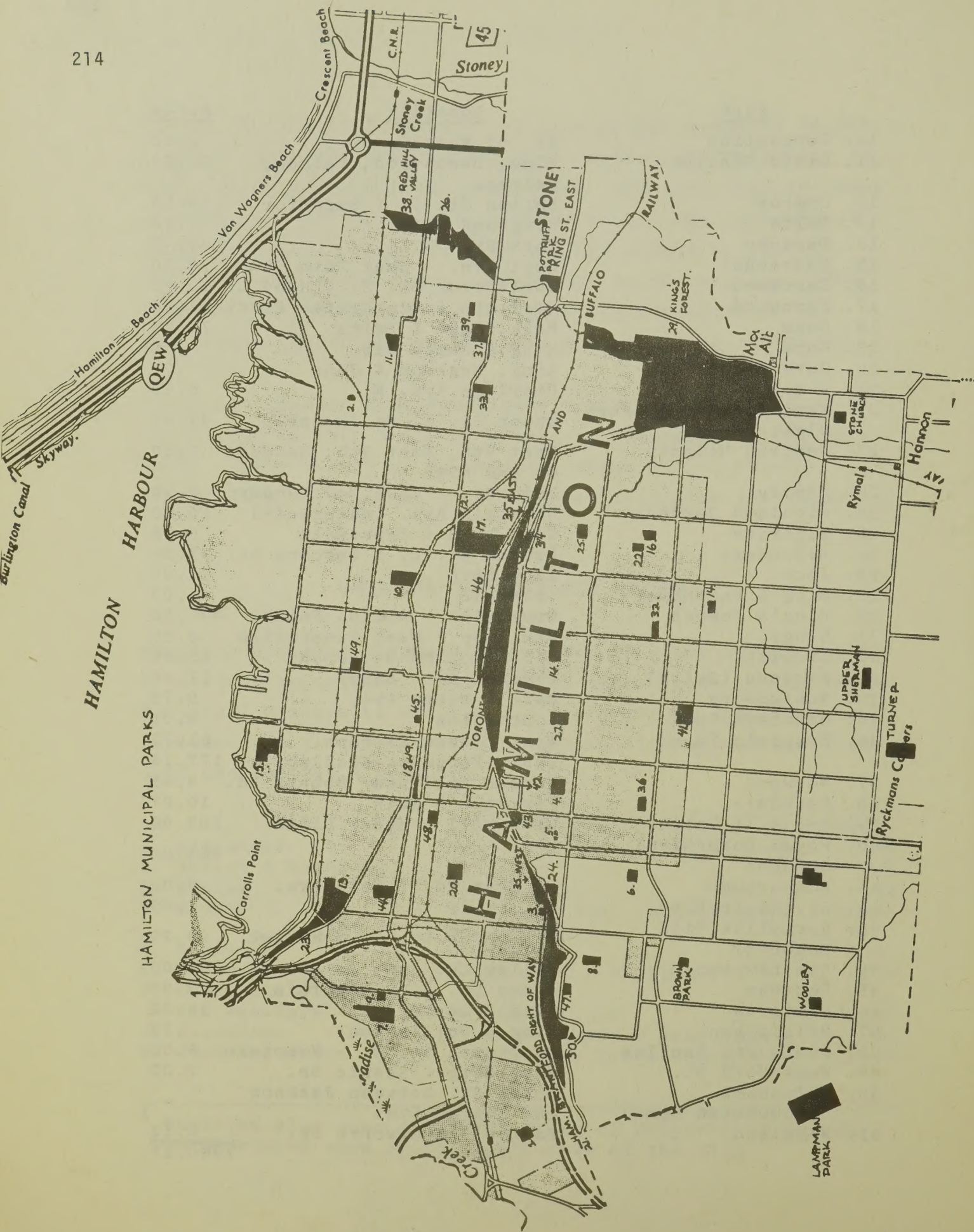
HAMILTON'S OPEN SPACE SYSTEM

Hamilton has approximately 1950 acres of parks or about 6.5 acres/1000 population. Included in this figure is the Royal Botanical Gardens of which 363.0 acres are in Hamilton. Not included are King's Forest Golf Course (125 acres) and Chedoke Golf Course (240.3 acres).¹

<u>Park</u>	<u>Location</u>	<u>Acres</u>
1. Alexander	West Hamilton on Whitney Ave.	9.10
2. Benson & Beach Rd.	Triangle	.30
3. Beulah	Beulah Ave.	.92
4. Bruce	Bruce Dale Ave. (end of Upper Wellington)	10.00
5. Buchanan	Brantdale	2.00
6. Buchanan Survey Park	South Bend & Laurier	6.80
7. Churchill Fields and Westdale	Marion & Cline	70.00
8. Colquhoun	Mountain Crest & West 23rd	9.30
9. Confederation	Near Stoney Creek Traffic Circle	200.00

¹ Hamilton also owns about 401 acres of property in the to-be-developed area on the south side of the city.

<u>Park</u>	<u>Location</u>	<u>Acres</u>
10. Coronation	Ft. of Macklin St.	2.50
11. Civic Stadium	King, Beechwood, Balsam, Melrose	20.92
12. Crerar	Barton St. E. & Superior	10.50
13. Delta	King and Main	.40
14. Dundurn	York St.	32.47
15. Eastmount	East Mtn. - East 26th St.	8.00
16. Eastwood	Burlington St. E. & Mary St.	10.00
17. Fernwood	West 9th & Winchester Blvd.	3.40
18. Gage	Main, Gage & Delta	71.43
19. Gore	King & James Sts.	.59
20. Gore Extension	King, Hughson & John	.32
21. H.A.A.A.	Charlton Ave. W.	6.88
22. Hamilton & Brantford Right-of-Way	Queen St. S. to Ancaster	47.00
23. Hampton Heights	East 9th, East 8th, between 44 and 45th	2.50
24. Harvey	York St. - Cont. of Dundurn	8.90
25. Highland Gardens	Mountain Ave. (reservoir)	10.00
26. Highview	East 45th & Bruce Dale	5.38
27. Hillcrest	Barton St. E. & Osborne St.	17.00
28. Inch	East 18th	12.00
29. King & Dunsmuir	Triangle	.02
30. King's Forest	Greenhill - Albion Falls	474.00
31. Langs	Mtn. top - West Sanatorium	3.00
32. LaSalle	Aldershot on Bay Front	55.00
33. Macassa (Smith)	Sherman Ave. South	17.40
34. Montgomery	Main & Berry Ave.	9.75
35. Mountain Park	Concession	9.05
36. Mountain Face	West- James-Emerson	61.73
	East- Ferguson-Kenilworth	177.16
37. Norwood	Warren Ave. near Mohawk Rd.	3.45
38. Parkdale	Parkdale & Main	10.07
39. Red Hill Valley	Greenhill - Hydro Line	102.90
40. Royal Botanical Gardens		363.00
41. Roxborough	Bingham Rd. & Reid Ave.	3.00
42. St. Clair Blvd.	St. Clair	.69
43. Sackville Hill Memorial	Wentworth St. S. & Mohawk	20.20
44. Sam Lawrence	Jolley Cut	20.00
45. Southam	James St. S. - Mountain	3.00
46. Victoria	King & Locke Sts.	14.30
47. Wellington	King & Wellington	.72
48. Wentworth Incline	Wentworth St. S. - Mountain	5.00
49. West 30th St.	West 30th & Scenic Dr.	2.00
50. Whitehern (McQuesten Home)	McNab St. between Jackson and Hunter Sts.	-
51. Woodland	Barton & Wentworth St.	6.12
	Total	1940.17



According to minimal open space standards (10 acres of park per 1000 population) Hamilton should have about 2987 acres of parkland.¹ Thus Hamilton has a deficit of approximately 1037 acres.

A breakdown by park classification can be made to determine at what level the park inadequacy is greatest. The following areas will be omitted from the discussion due to the unique nature which places them in a "green belt" category. Instead they will be viewed as helping to compensate deficiencies in each category.

Hamilton-Brantford Right-of-way	47 acres
Mountain Face	238 acres
Redhill Valley	<u>102</u> acres
Total	397 acres

Using the same standards as applied to Burlington (which are less stringent than those proposed for Hamilton, see pages 188 and 202) Hamilton should have 745 acres of neighbourhood parks but only has 291 acres. That equals a deficit of 454 acres.

Hamilton should also have 745 acres of community and district parks but in fact only has 101.27 acres.² That is equivalent to a 643.73 acre deficit or about 18 community and neighbourhood parks.

As for city-wide or regional parks, Hamilton should have 1490 acres and has 1178.43 acres.³ This equals a 311.57 acre deficit.

¹ Calculation assumes Hamilton's population is 298,700.

² Dundurn (32.47) Sam Lawrence (20.00), Victoria (14.4), Macassa (17.4) and Hillcrest (17.0).

³ Confederation (200), King's Forest (474), Royal Botanical Gardens (363) Gage (71.43), Churchill Fields (70).

This deficit could be alleviated by the purchase of the Lax Development which would also supply needed acreage with access to the Bay (see page 220). Combined with the development of the 145 acres of the Lampman farm which has been purchased (Rymal Road West) and the existence of green belt acres as suggested in the Hamilton Open Space Report, the inadequacy on this level could be reduced to an almost acceptable level.

In summary, Hamilton's main deficiency is neighbourhood parks. This, along with the location of parks, leaves the majority of Hamiltonians beyond reasonable access distance to park facilities, thus heightening the deficiency. The linkage system suggested in the Hamilton Open Space Report would assist in alleviating this inadequacy.

Past Performance in Acquisition

A look at Hamilton's park history in light of its population for the past ten years is helpful to discern whether Hamilton is making any significant changes in its approach to open space. (Note: the Chedoke Golf Course acreage has been subtracted for each year, and the 1970 figure reflects the subtraction of the 125 acre King's Forest Golf Course).

Year	Acres of Developed Park	Population	Acres/1000
1960	1746	258,576	6.7
1964	1686	273,935	6.2
1968	2090	291,536	7.1
1970	1985.6	296,826	6.7
1971	1943	298.755	6.5

These figures indicate that the amount of open space has remained relatively constant. However, combined with the social changes of the past decade (more leisure time and more

apartment dwellers) these figures imply a deteriorating situation.

A Case Study

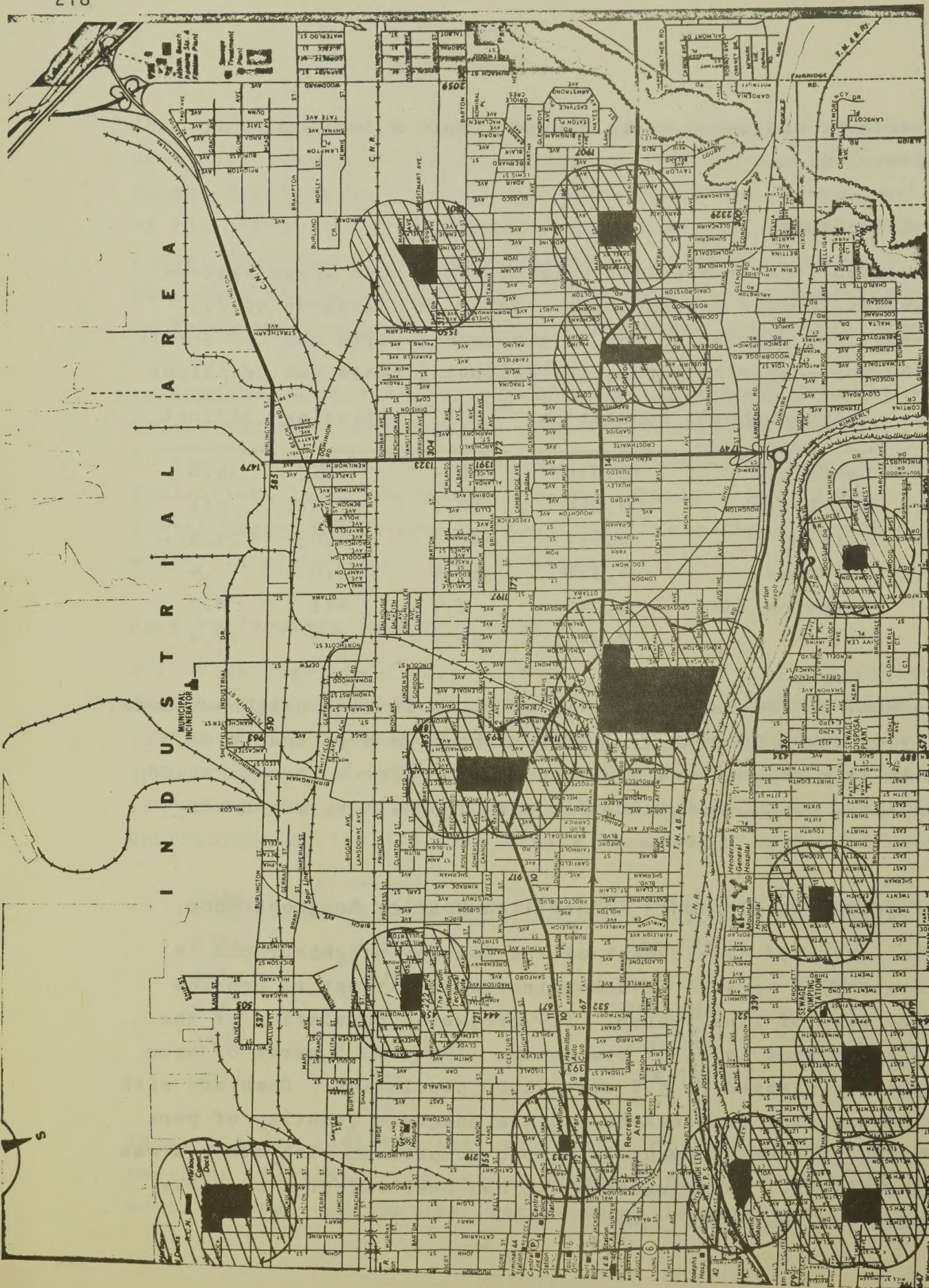
A random look at specific neighbourhood open space systems reveals serious inadequacies. Based on standards of 2.5 acres/1000 population for neighbourhood parks and 1.0 acres/1000 for community parks, the following table was prepared:

Neighbourhood	Population	Required Acres	Existing	Deficit
Landsdale	10,354	36.4	1.1	35.3
St. Clair	4,046	14.2	37.18	nil
Stipley	8,987	31.5	7.02	24.5
Corktown	5,138	16.8	16.4	.4
Glenview West	2,443	8.7	nil	8.7
	7,347	25.9	1.5	24.4

As well as the large deficits of parks in some neighbourhoods, a very large portion of Hamiltonians live more than $\frac{1}{4}$ of a mile from a park (see map page 218). (For a more detailed analysis of accessibility for all of Hamilton, see Draft Report on Open Space).

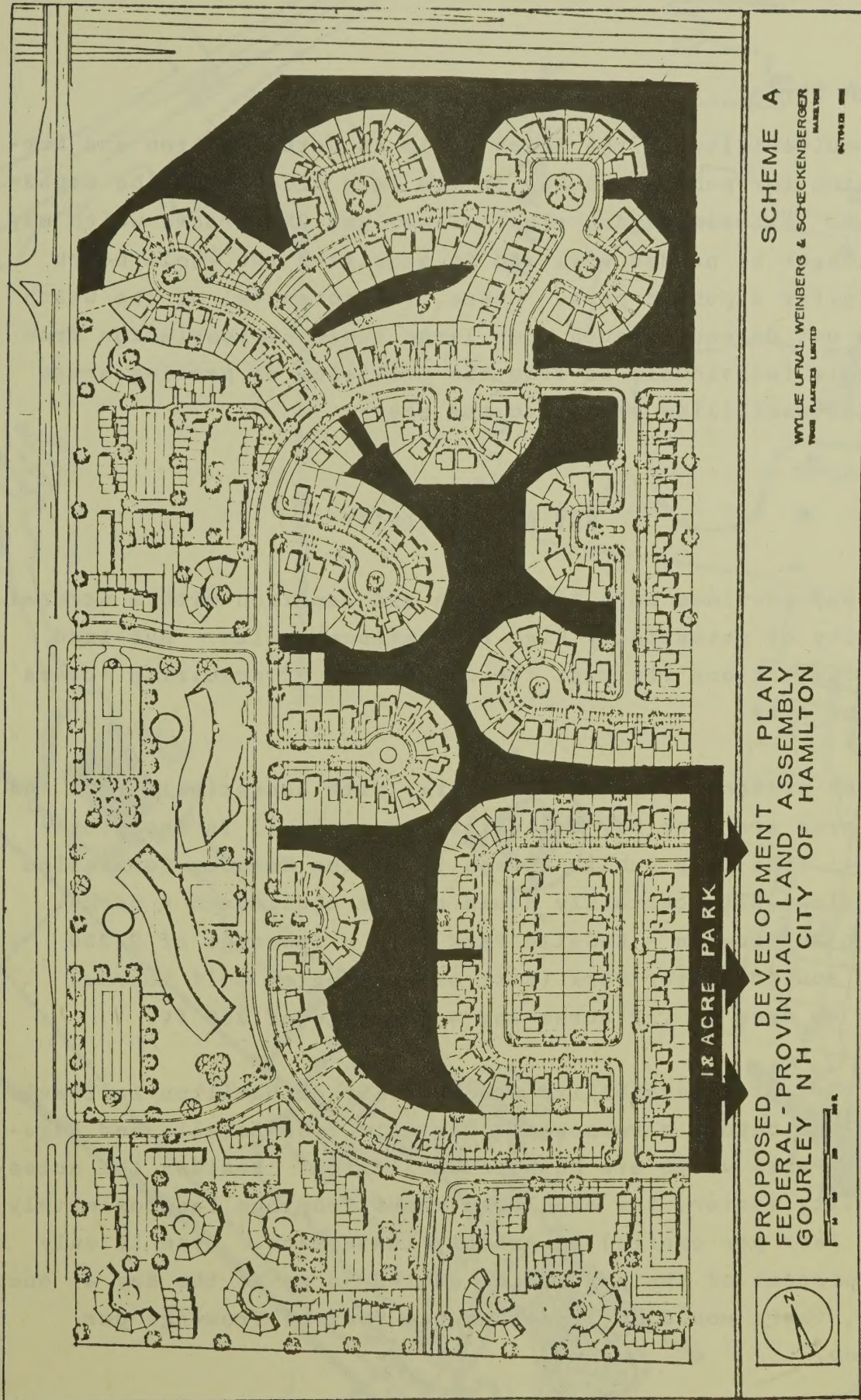
Projected Developments in Hamilton-Gourley Neighbourhood.

The projected development of the Gourley neighbourhood is interesting because it demonstrates an attempt to provide some type of link system. The projected population of the neighbourhood is 5,354 residents. About 35.5 acres of open space is planned or 6.5 acres/1000 population. Combined with pleasant link connections and the adequate quantity of park space, this development is beyond comparison with other areas in Hamilton. Unfortunately, it has been rejected by Parks Board (see map page 219).



HAMILTON: PARK ACCESSIBILITY

AREA WITHIN 1/4 MILE RADIUS



PROPOSED DEVELOPMENT PLAN
FEDERAL-PROVINCIAL LAND ASSEMBLY
GOURLEY NH CITY OF HAMILTON

SCHEME A

WYLIE UFNAL WEINBERG & SCHECKENBERGER
PLANNERS LIMITED

SCALE 1:1000

PUBLIC OPEN SPACE

Beach Strip

The suitability of the Beach Strip in both Hamilton and Burlington for public beaches on the lake side should be emphasized. Existing hydro right-of-way and CNR tracks which may no longer be needed will aid in acquiring the whole beach strip for a public park. Hence, the potential of the beach does not depend so much upon large scale expropriation from private individuals as from the provision of parking areas and accessibility routes to the beach.

BAY ACCESSIBILITY

The Bay provides both Burlington and Hamilton with a natural amenity of potentially high recreational value. But land use limitations restrict the capability of acquiring access to the area.

At the present time the only parks with accessibility to the Bay area are (see Bay accessibility map): 1) In Hamilton - none. (The only public access is at the Harbour Commission Building which certainly could not be considered a park). 2) In Burlington - LaSalle Park with a frontage of 2,250 feet and Edgewater Park (East of Burlington Golf Course) with an area of .12 acres and a frontage of 250 ft.

In terms of accessibility the majority of Hamilton residents are well beyond a reasonable distance from LaSalle and Edgewater Parks which are both in Burlington. Besides the accessibility factor, the available water frontage (approximately 0.08 feet per capita) is grossly inadequate. Even if only one percent of the population wanted to go to the Bay at one time, there would be less than one foot of frontage per person.

Potential Sites for Bay Access

Cemeteries and golf courses have a high capability of attaining a secondary function as passive parks. Two cemeteries (Woodland with a frontage of about 7,500 ft. and Holy Sepulchre with a frontage of approximately 2,750 ft.) and one golf course (Burlington Golf and Country with a frontage of 2,500 ft.) could provide needed access to the Bay. Neither cemetery comes close to its potential development, thus each could be designed to incorporate this role. Another possible location (now in private hands although ownership is disputed) is Brighton Beach between Woodland and Holy Sepulchre cemeteries. The shoreline of Brighton Beach and the two cemeteries are too rugged for easy access, but this could be modified by excavation.

The only potential area within Hamilton city limits is the Lax Development. The land fill in this area is to be approximately 82 acres. Thus as well as providing desperately required Bay access, it would also fulfill the need for four city-wide parks.

It is argued that if the Lax Development proceeds in the projected direction, the city residents will be provided with adequate Bay access. However, plans for the project which is known as "Bal-Harbour" illustrates the illogical nature of this view. The development includes 19 acres of existing shoreline and 82 acres of land-fill area.

Using the minimal standards of 2.5 acres of neighbourhood parks and 2.5 acres of district and community parks per 1000, the Bal-Harbour development would require about 45.5 acres of park. It is supplying a miserly 9.6 acres. Hence the development will not even supply adequate open space for its

own residents, let alone the city of Hamilton. As well, this development will destroy the aesthetics of Harbour Park.

SUMMARY AND DISCUSSION

The actual specifics of the Hamilton and Burlington open space systems, as outlined in this report, demonstrate the inadequacy of the facilities. Burlington while requiring an absolute minimum of 810 acres of park has supplied 600 acres or 75% of what is required, Hamilton while requiring 2,987 acres has provided only 1,943 acres, or 65% of what is required.

Playgrounds and parks in the area in many cases are indicative of the barren, sterile approach to recreational facilities. The absence of linkage systems minimizes the potential for recreational activities such as walking and bicycling. Traditional arguments employed against the link systems now appear to be without foundation, as a result of the Bramalea experience.

Lack of waterfront accessibility to both Hamilton Bay and Lake Ontario is probably the most intolerable deficiency in the existing facilities. To destroy the utility of areas with such high recreational potential by permitting development is a severe mismanagement of resources. In the case of Hamilton Bay, it seems to have been concluded that the high level of water pollution will continue, thereby acting as a deterrent to utilization of its recreational potential. In Burlington, the quantity ethic has created a situation which threatens to consume every last foot of remaining potential lakefront park area. Leading politicians have balked at the idea of acquiring any more lakefront property, arguing that more acres of land can be acquired

somewhere else for the same price. This approach completely neglects the qualitative advantage of the lakeshore.

The appeal for growth and quantity - the accommodation psychosis which neglects the alternative to high population growth and intense urbanization - has produced a situation plagued with inadequacies.

High rise development in overcrowded neighbourhoods which lack adequate open space facilities is a price which authorities seem willing to pay for the sake of growth. The possibility of psychological disorders aggravated by this type of living, and the lack of economic value of high rise for the coffers of the municipality are largely ignored. The lack of communication between agencies and the failure to include sociological and qualitative considerations in the planning process has created a process in which facilities are considered a luxury.

The perpetuation of planning which epitomizes growth and quantity, places open space on the periphery of priorities, seems tragic, illogical and irresponsible. In short authorities must begin to plan for *people* as opposed to *growth*.

Studies dealing with recreational needs of area residents are inadequate. Past usage figures underestimate the needs of the people. These figures ignore social trends, the psychological users, and the cyclical increase in usage that comes with increases in facilities.

Moreover, existing open space standards are generally in-

adequate. They do not take into account aspects of accessibility and quality. A sounder basis is needed to determine the minimum amount and type of open space required to provide residents with the facilities needed to engage in pleasurable activities. A province-wide study should be undertaken to determine what these minimum requirements would be. The TORPS study has begun a sound inquiry into this area but it is dealing with the question on a provincial rather than a municipal level. In the meantime Authorities should not be concerned about the possibility of too much open space. It is extremely unlikely this situation will ever arise. Problems occur, however, when too little is provided.

As well, the existing open space standards do not differentiate between the open space requirements of multiple unit dwellers and single residential dwellers. Minimum requirements for multiple unit dwellers as researched in the Michelson Diamond Study should be:

1. an outside private green space area for each unit equal to the floor area less the bedrooms,
2. for each 30 - 75 families a 150 ft x 150 ft collective recreational area, and
3. for children, a play area 50 ft x 50 ft for each 30 - 75 families.

But as illustrated in this report, in high density zoning allowing 500 units per acre, it is impossible to meet these requirements. It appears then that allowable densities should be decreased to a maximum of 50 units per acre.

Existing means of financing open space are probably indicative of the lack of concern for open space as a priority. The 5% dedication fee, the mainstay of park finances, would,

if minimal open space standards were met, allow for a maximum density of 5 people/acre, a density which is almost non-existent in the Hamilton/Burlington vicinity. By being based on 5% of the land area, as opposed to the density, the fee is totally unrelated to the need. In fact, in the case of highrise development which produces an increased need for open space per capita, the developer should be required to pay a fee which is based on the number of residents being housed.

Land speculation is one of the major impediments to acquiring open space. One means of combatting this would be for the municipality to lease land to industry. Hence, when the operation is phased out as in the case of the old CNR land, the municipality can retain control of the land without a large expenditure. If open space facilities are required the land can easily be made available. In present circumstances, the land usually becomes so expensive that it is possible only for highrise developers and other industries to buy it.

Also, zoning changes from low to high density should not be allowed until sufficient open space has been acquired in the area. Increasing the allowable density increases the market value of the land, thereby decreasing the ability of the municipality to acquire sufficient open space.

CONCLUSIONS

1. The open space systems in both Hamilton and Burlington are inadequate in terms of both quantity and quality. Burlington possesses a deficit of approximately 221 acres, and Hamilton, a deficit of approximately 1037 acres.
2. Existing access to both Lake Ontario and Hamilton Bay is well below satisfactory levels. Potential access sites are definitely limited.

3. Generally, open space standards (ie. 10 acres/1000 population) have become antiquated.
4. Financial arrangements for funding open space acquisition make it impossible to obtain sufficient quantities.
5. The linkage or green belt concept is essentially non-existent in terms of implementation in the study area.
6. Under existing high density maximums, it is physically impossible to supply adequate open space facilities.
7. Current approaches to open space planning tend to ignore the use of parks on a psychological level as opposed to actual physical usage.
8. Statistics on past performance of park acquisition show that the situation is deteriorating.
9. Traditional arguments against green belts or linkage systems are invalid.

RECOMMENDATIONS

1. In both Hamilton and Burlington increased amounts of open space facilities should be acquired.
2. In the case of Hamilton, the major thrust in alleviating this deficit should be on the level of neighbourhood parks within the immediate vicinity of residents, and in Burlington, on the level of large, town-wide link parks.
3. Increased accessibility to the waterfront of both Lake Ontario and Hamilton Bay is required. Fulfilling this need is urgent, due to the decreasing number of potential waterfront accessibility sites. In Burlington, the last remaining 24 acres of potential lakefront property should be purchased. Woodland and Holy Sepulchre cemeteries, Brighton Beach and the Burlington Golf and Country Club should be utilized to alleviate this problem. The Lax Development in Hamilton Harbour should be expropriated to provide Bay access.
4. Open space standards should be upgraded to take into account social trends which have increased open space requirements.
5. Financial arrangements should be changed if adequate open space is to be provided. The 5% dedication fee should be replaced by a fee based upon a per capita requirement.

6. Both the adventure playground concept and linkage green belt system should be implemented.
7. Psychological utility of open space should be considered as a significant function of the facilities. The number of people going into a park should no longer be used as the only basis for park evaluation.
8. In areas where open space facilities are inadequate, future developments which would increase the density of population should be postponed until the facilities are brought up to a satisfactory level.
9. High density development (50 units/acre or more) should be terminated unless sufficient open space can be supplied. In all instances this would require, in terms of open space, that 100% of a proposed development area be functional as open space, or that an adjacent piece of land, at least as large as the area to be developed, be made available

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CHAPTER EIGHT

HISTORICAL SITES : HERITAGE OF THE PAST

jane meikuz

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HAMILTON

George Hamilton's town site of 1833 was a rough-hewn and common-place one, with townsfolk's dwelling places consisting of cabins and frame houses. Within a short time the town acquired a cluster of stores, shops, churches, and administrative buildings along with an increasing number of elegant homes.

At the time of this report, Hamilton is celebrating its one hundred and twenty-fifth anniversary. Yet the city can only boast of having about two buildings which are over one hundred and twenty-five years in existence. Due to fires and expropriations, many of Hamilton's fine old homes, hotels and office buildings have been lost. It is our duty to our city's heritage to ensure that the present old buildings be restored and kept intact.

The object of my study has been to seek out information of the existing old buildings, of the preservation attempts and architectural conservancy on the part of the city and the historical societies, and of the buildings that have been ruined.

PRESERVATIONS AND ARCHITECTURAL CONSERVANCY IN HAMILTON

The city of Hamilton has recently spent about sixty thousand dollars in restoring Whitehern, the home of the McQueston family built in 1948. Whitehern houses many artifacts, engravings, and paintings collected over the years by the family members. Also the period furnishings of the refined dining room and drawing room prove perfect examples of mid-Victorian pieces. Behind the house is a walled English garden.

Describing Whitehern, Alexander G. McKay says that "the facade has a convention Georgian symmetry which might pass for one of an earlier vintage - small-bracketed eaves, a graceful Ionic porch, classical entablature - but the Italianate touches detected in the treatment of the balustrade, and, beneath the crowning pediment, the round-headed key-stoned window, a pale reflection of some triumphal arch of ancient days."¹

In 1899 the city purchased Dundurn Castle, the home of the late Sir Allan Napier MacNab. In 1967 Hamilton undertook the restoration of this regency mansion as its centennial project. Dundurn Castle is Hamilton's best known monument. Built in 1835, MacNab was trying to reproduce an English country gentleman's estate on Burlington Heights. This is one of the few existing buildings which has survived as a remembrance of a bygone era.

The style of Dundurn is of the Regency Period and embellishes many features of the Italianate country villa: balustrades, ornamental brackets, the twin watch towers, and the columns of the porch belong to the Doric Order (Roman). These elements

¹ Alexander G. McKay, *Victorian Architecture of Hamilton*, 1967, Hamilton, p. 7.

combine to give this complex building a picturesque air. Dundurn is grandiose and varied, for it incorporates the manor house, a dove-cote, two dependencies in Castle Dean and Battery Lodge, the gate-house and the cock-pit.

Although Sir Allan's mansion was the most conspicuous of the time, there were others in Hamilton that tended "... to reflect the classic vocabulary of the Renaissance in the English manifestations of Jacobean and Georgian."⁴ The Roach House built about 1850 is made of the city's limestone. It is an early version of the Italianate with its projecting eaves and single brackets. The main entrance is flanked by coupled square columns. Another interesting feature is the central round-headed window with an arch and a sculptured keystone. The building was originally designed for George Roach, a former mayor of Hamilton and still stands at 55 Barton Street West. Being one of the oldest homes still left in Hamilton, the city should undertake to restore it since the building has become rundown due to the many tenants it has seen in its day.

Another restrained Italianate villa with its characteristic projecting eaves and brackets is Arlo House. This building has recently been converted into a dental clinic yet the symmetrical centralized character of the house has been preserved. The sloping roof with its wide overhang is derived from the Italianate or Tuscan style of architecture.

Poised on various levels of the mountain at the Hairpin turn stands Rock Castle in all its picturesque Gothic style. The irregularity of this building is its interesting feature. Its Gothic character is revealed by its pointed arches, buttresses and its pinnacles. The clustered chimneys also reveal the castle's Gothic spirit. The manor is said to have

⁴ Head-of-the-Lake Historical Society, *Wentworth Bygones*, Hamilton 1967, p. 46.

been designed for Mr. Carpenter of the famous foundry Company, Gurney and Carpenter. But it was also used as a church at the time. "It has been identified as the Old White Church, occupied first by the American Presbyterians, then by the Methodists, and later abandoned".⁵ Until recently Rock Castle was an apartment house. But with the building of the New Claremont Access and the New Jolley Cut it has again been abandoned. The city could strive to clean the thick dust of Rock Castle and once again let it be a showpiece as it had been when built about 1848.

Sir Isaac Buchanan, renowned as a financier, merchant and Conservative Member of Parliament for Hamilton chose to establish himself in a Gothic castle called Auchmar on the Hamilton Mountain. The manor house built in 1855 is two stories high; some of the intricate and skillful features are the steep gables and the decorative chimneys. The Gatekeeper's Lodge made of stuccoed brick is a fine example of the small picturesque Gothic cottage. The gatekeeper's lodge has the same architectural lines as the manor house. Both have intricately designed clustered chimneys and arch-styled gable windows. Today Auchmar is called Mount Cenacle. It is the home of the Sisters of Social Service, a Roman Catholic group of nuns. Auchmar now stands in its former splendour surrounded by a high stone wall amid well-groomed gardens.

At 250 James Street South stands a fine house designed by the Hamilton Architect, James Balfour. It is noted for its fine mansard roof and its Victorian dormer windows. This steeply pitched roof has only one dormer facing the front of the house. The windows are arranged symmetrically; they are shuttered and crowned with stone arches. Many houses in the Hamilton area have come from the drawing board of James Balfour

who is said to have worked with the famous American architect Henry Hobson Richardson.

Richardson's Romanesque made powerful headway into the Hamilton domestic architectural scene after 1880. A fine example of the Romanesque still towers at 252 James Street South opposite the new wing of St. Joseph's Hospital. Designed by architect W. A. Edwards and built in 1891 this house boasts conical slate roofs. This towered gable-style house with its many round-arched windows is reminiscent of the Romanesque style.

The buildings mentioned in this section have been restored to their former splendour. They have also been taken care of either by the city or the private owners. If more thought was given to our heritage, we could boast of more buildings that have survived 125 years. But as things stand today we have few places which can be called historical sites.

HAMILTON HOMES BEFORE AND NOW

Many of Hamilton's fine old buildings which she could boast of as being 125 years old or older have been demolished to make way for "progress". Abbotsford Hall was begun in 1838. It was situated opposite McMaster University on Highway #2 on property known as Bambergers. The columns for the portico were again in the Roman Doric tradition. They were brought over intact from Scotland. The stone masons who were to do the masonry work were also brought over from Scotland. The simplicity of the plan and proportions were what made this house outstanding in design. It should be noted that in these typical English style town houses, the kitchen and the service

quarters (pantry etc.) were located in the basement. Abbotsford Hall, Whitehern and many of the other old Victorian homes were constructed in this way. They were a simple reduction of the late 18th. century architecture in their homeland (British Isles).

Frederick J. Rastrick, a noted English architect came to Hamilton in 1853. He designed in terms of the Gothic Revival. The Ambrose house on Charlton Avenue by the hospital's parking lot is Mr. Rastrick's Gothic Revival at its best. Through the years it has become grey but one can still see the fine architectural refinements of Rastrick's design. Here, he embellishes his creation with ornamental finials, labels over windows and elaborately decorated verge boards and with many gables and clustered chimneys. This house was sold to St. Joseph's Hospital in 1960 for \$60,000.00. The future looks dim for the Ambrose homestead. It will probably be torn down to make room for hospital expansion or parking.

Frederick Rastrick's masterpiece stands at the corner of James Street South and Duke Street. "The Castle" as it is called was built about 1857 for Colin Reid. It is an imitation of the Scottish baronial castle. It once stood high above street level surrounded by large grounds and a fine stone wall. It is another Rastrick design in the Gothic Revival manner. It still boasts its finely decorated gables, its many clustered chimneys and its ornamental finials. Today "The Castle" also known as "Amisfield" stands in ignominy. It has been marred, mutilated, degraded and obliterated through time. The fine front entrance has been blocked off and an office building or apartment development has been attached to it. Further degradation came when a service station was erected on its front lawn.

A subtle version of the Italianate villa once stood at 76

Arkledun Avenue. This fine stone building at the foot of the escarpment was typical of the Tuscan villa and was elegantly equipped with many Classical Revival ornaments. A square central tower represented by a belvedere topped this handsome house. Characteristic of the Classical Revival ornamentation were the stone console brackets at the windows and the doors. The low pitched roof, the overhanging decorative bracketed eaves, along with the Corinthian styled porch and entablature were all a part of this elegant house. Today, at 76 Arkledun, we find a high yellow-stoned apartment dwelling.

HAMILTON CHURCHES AND SCHOOLS

The first formal religious services (Methodist) were held in a log school house at King and Wellington streets, the site of the former First United Church. The Methodists purchased land from Colonel Land at the corner of Main and Wellington and built the First Methodist Church.

In 1868 the Centenary Church was erected taking its name from the fact that the centenary of the American Methodist Church was in 1866. This elegant stone building was considered one of the finest Methodist churches in Canada. Today this church still stands at its former site on Main Street West near James. It is now a United Church and still serves its patrons. However, the church does not stand amid gardens as it did in its former years; rather, it is flanked by parking lots.

The Presbyterians followed the Methodists. Their first services were held in the log courthouse. In 1854 the cornerstone was laid for the present edifice towering above Hamilton

at the corner of James and Jackson. It was first known as St. Andrews but today is called St. Paul's Presbyterian Church. St. Paul's is considered one of the most outstanding stone churches in Hamilton. The soaring spire reaching 180' into the sky is one of the finest in Canada as well as being one of Hamilton's focal points. The original bell is still used in the belfry of the Sunday School. It once served as the town bell and to summon the faithful to worship. We still hear this bell toll the quarter-hours away. The pointed arches, the arched windows, the plaster vaults and the wooden tracery are all in the Gothic tradition with the exception of the wooden tracery. True Gothic form used stone tracery.

The First Baptist Church was located on Park Street in a brick building in 1846. The building was replaced in 1861 and again in 1875. A lot was purchased at James and Jackson for the construction of James Street Baptist Church. In 1879 the walls of this building tumbled down and a new edifice was constructed in 1882. This building still stands there today. It is a massive stone building with pointed arches and pinnacles. An interesting stained glass window is the focal point of this church.

Below the mountain, the Anglicans were meeting in the old log courthouse until 1835 when the cornerstone was laid for Christ's Church. It was four years before the building was finished. At the present time, the same building stands on James Street North which was at one time the centre of town. In 1852 the nave and chancel were added. In 1875 this church was designated the Cathedral Church of the diocese of Niagara. The church is made of fine stone from the area. It has three front entrances which give a balanced look to the church. It has pointed arches and pinnacles typical of Gothic architecture.

The earliest Christian teachers in this area were the Roman Catholic missionaries who followed La Salle and other French explorers. The first Catholic Church seems to be St. Mary's which was in existence in 1827. In 1856 Reverend Farrell was appointed the first bishop of the Diocese of Hamilton. St. Mary's, then a frame church, became the Cathedral Church of the Diocese of Hamilton. This building was destroyed by fire in 1859 but a new building was dedicated in 1860. This large brick building still stands at Park and Mulberry Streets. St. Mary's was the Cathedral Church until 1927 when St. Patricks was announced to be the new Cathedral Church. In 1933 the Basilica of Christ the King was named the new Cathedral Church.

The Jewish community founded its congregation Anshe Sholom in 1853. In 1882 the present synagogue was dedicated. This mosque-like structure no longer stands today on its original site at 143 Hughson South. The new synagogue is located at 215 Cline North.

HAMILTON BUILDINGS BEFORE AND NOW

There still remain some fine old buildings in Hamilton. Others have been demolished or destroyed by fire. One of Hamilton's most distinguished buildings still stands at 51 Stuart Street West. The building is in a Classical Style, and is one of the finest Pre-Confederation buildings of Hamilton. "It constitutes one of the best examples of Palladian or Renaissance Italian style architecture in Southern Ontario. Partly mutilated and reduced to mean circumstances in a blighted environment, the building still bears marks of its former elegance".⁸

⁸ *Ibid.*

On the lintel of the square-columned portico is written the inscription "Victoria Regina". The building had been dedicated to the Queen in her honour. The columns of the portico are coupled like those of the Roach House. The two stories are of a completely different architectural style. The ground floor is made of cut, rusticated stone, whereas the second floor is made of a smoothly cut stone. The windows on both floors are also different. The bottom floor windows are arched, the arched-effect is evident in the stone around these windows. The second story windows are embellished with many architectural refinements. The windows are flanked by pilastered jambs, and the entablature (architrave, frieze, cornice and pediment) are in the Renaissance tradition. The second floor has rusticated quoins at the corners of the walls. The parapet which crowns the building was originally topped with Grecian urns.

This building has had many uses in its day. It has been used as the customs house, as a storage place, as a school and even a place where mothers met under the leadership of Adelaide Hunter Hoodless. Presently, this fine old public building, erected about 1860, is occupied by Naples Macaroni Company.

The Old Pump House built in 1860 is another engineering marvel of Hamilton. This building still stands on Woodward Avenue as a monument to the ingenious design and engineering skill of its architect and engineer, Thomas C. Keefer. The exterior of the building is made of rusticated, cut stone. The windows are rounded arches, very classical in design. The interior of the building is supported by large cast iron columns and fluted rods extending from floor to ceiling. These classical columns give it a Grecian look - like a greek temple. The

pump house has not been used since 1920, and though it is today a museum piece it is still capable of running efficiently.

Another building which has not been torn down or destroyed is the Commercial Block which survives at McNab and Merrick Streets. It still serves its original function, that is as a wholesale clothing establishment. Built in 1858, it is one of the few surviving impressive warehouses. Though it has become grimy through the years, it nevertheless reveals a master's design. It is an impressive and symmetrical three-storey edifice. The basement and first-storey windows are round-headed whereas the second and third storied windows are square in design. The quoins of the building are vermicular, that is, the masonry looks as though worm-tracks have been cut into it. Another interesting feature is the Mansard roof with the many dormer windows. Another feature which many people are unaware of is the court yard behind the double doors facing McNab Street. This building has served Hamilton merchants for more than a century and today it continues to serve the needs of Cambridge Clothiers.

In the heart of Hamiltons downtown area opposite Gore Park stands the fine red sandstone Henry Birk and Sons Building. Built in the 1880's it was originally the Canada Life Assurance Building. The stone and marble for this edifice were imported and no expense was spared. The architecture of the building is part Gothic and part Romanesque. The three stories all hold symmetrical rows of pointed arched windows. "The original clock, later destroyed by fire, added a Germanic touch to an already eclectic building, a medley of Romanesque rotundity and Gothic pointed-arch fenestration."¹⁰ The original clock has been replaced by the familiar clock now

¹⁰ McKay, Lexander, *Victorian ARchitecture in Hamilton*, Hamilton, 1967, p. 26.

perched at the James Street side of the building. James Balfour's architectural gem has been the home of Henry Birk's silversmiths and jewellers for many years.

The City Hospital was one of the first hospitals in Hamilton. Originally the building was a hotel situated at the foot of John Street overlooking the bay. In 1847 it accommodated seventy beds and continued to serve the city until 1882. In that year it was moved to Barton Street East where a new hospital was erected at the cost of \$50,000.00. The main building itself is a fine example of Victorian architecture. The windows are round-headed and of a contrasting stone to the red-brick walls. The mansard roof has dormer windows and the roof is decorated with wrought iron. Today however, we note that an attachment has been made to the main building covering up the arched windows and the coupled square columns. We may also note that the original Gore Park fountain once stood in the front of the hospital. More new additions have been made to the hospital in the past, yet it still serves the community well.

ANCASTER

"Ancaster Township owes its name to a whim of Upper Canada's first Lieutenant Governor John Graves Simcoe...Ancaster is from the name of a Lincolnshire Parish which is situated on an ancient Roman Road that led to a Roman camp."¹²

Other than the Indians, the first settlers here were the United Empire Loyalists who fought with the British in the American Revolutionary War. The first settlers came to this

¹² Woodhouse, T. Ray, *"History of Ancaster Township", Ancaster's Heritage*, Hamilton, 1970.

area in 1789 but the Township was not named or surveyed until 1793. For the first thirty years Ancaster was the largest and most important village within a forty mile radius. But by the 1830's Hamilton outgrew Ancaster and also Dundas.

Ancaster grew up around the grist and saw mills of one of its first settlers, James Wilson. Near his mill, Wilson built an inn. He also built a blacksmith shop, someplace where other settlers could get their tools made or repaired.

Ancaster has been the scene of many fires and consequently many of her old buildings have long ago been removed from the village. Yet there still exist many fine old residences, churches and public buildings.

PRESERVATION AND ARCHITECTURAL CONSERVANCY IN ANCASTER

In Ancaster, many fine old homes and estate mansions have survived. Also some inns, hotels and mills have been preserved. Yet there are many that have been completely demolished or lie today in a heap of piled stones and wood.

The first homes of the eighteenth and early nineteenth centuries were probably old country cabins and cottages. These were usually dwellings made of logs resting on stone foundations, and put together with mortar. Most of these were made of limestone found in the area. Most of these houses were heated by logs burnt in the fireplace. Later iron stoves were used by people who could afford them.

Some of the old mills have been restored very closely to their original form of architecture. For example, one such structure

is the Cope's Mill on the old road to Dundas. It was built in 1863 by Alonzo and Harris Egleston and was restored in 1963 by Howard Cope. The building is a two and one half storey structure made of fine stone from this area. It is simple in structure and architectural detail. The windows are small and much longer in length than in width. The roof is slanted and two dormer windows are perched on the roof. A covered porch with a slanted roof supported by three posts symmetrically covers the front entrance.

Another building which had stood in ruins for half a century was Eyre Thuresson's Foundry. Built about 1860 it was restored in 1955 by Gordon J. Hutton who has made it his home. This building stands on the south side of Mill Creek between Wilson Street and the dam of the Ancaster Flouring Mill owned today by Howard Cope. About a dozen years ago the foundry was merely a stone shell, a ruin of gaping doors and windows. Today it is a one storey stone residence, number 509 Wilson Street.

ANCASTER HOMES BEFORE AND NOW

Wilson Street in Ancaster is the site of many fine homes. In 1838 an old two storey stone building was built at 375 Wilson Street by George Brock Rousseau. The house is a sturdy stone building which has a recessed front entrance. All of the windows of the two stories are white double windows flanked by painted shutters. Even the roof has elegantly refined architectural details. It is a distinctive low pitched overhanging roof with bracketed eaves.

David Richardson had the large two storey residence at 343

Wilson Street built as a marriage gift to his son Dr. Henry Richardson. Built in 1873, this spacious building is surrounded by well-kept gardens. The house is well-built of sturdy stone probably of this area. The windows of the house are all square and flanked by painted shutters. The front slightly projects from the rest of the house. There is a large round-arched window which is symmetrically placed above the front entrance. A gable tops the projecting front part of the house. The roof overhangs with projecting eaves and brackets. The clustered, ornamental chimneys are another fine architectural refinement of this house.

"Mountain Park" is the charming name of the home of Charles Mewburn of Ancaster. North of the Mohawk Trail near the Lime Kiln Road, it was built by Robert Berrie about 1822. Mr. Berrie, a solicitor from Hamilton used this Ancaster house as a summer home before he moved into it permanently. This fine stone residence is said to be one of the oldest in the township. The stone was probably excavated from this area. The front entrance has a covered porch supported by coupled Corinthian columns. These columns support the crowning pediment. The square windows are not placed symmetrically; there is one in the left hand side of the front entrance and two on the right hand side. There is an attachment, somewhat like a sun porch on the left side of the house which was probably added later. A fine architectural feature of the house are the well-sculptured chimneys. Pleasant grounds surround this archaic residence.

"The Grove" at Fiddlers Green Corner was built about 1842 by William Augustus Gott. It was named "The Grove" because of the fine grove of oak trees surrounding the house. This one storey stuccoed house is divided into three parts, all possess-

ing symmetry. The front entrance is rich in architectural refinements. The square door is flanked by two very long thin windows and on each side of these windows are finely made wrought iron lanterns. A window in a half-moon sits directly above the door. The arch in which the front entrance is placed is slightly recessed. On each side of the front entrance are two rectangular windows traced in wood. This elegant house is handsomely equipped with a sloping roof, and overhanging bracketed eaves. On each side of the main part of the house is an attachment slightly recessed from the rest of the house. These additions are made of the same stone, have the characteristic roof and the same style of windows. The only feature which the additions lack are the bracketed eaves. The estate home has seen many owners in its day.

"The Hermitage" was first built in 1827 by the Reverend George Sheed who came to Ancaster from Scotland. The first building bearing this name was originally a manse. In 1853 this building and its 400 acre estate were sold to Captain George Gordon Leith. He replaced it with a large well-made stone building which he also called "The Hermitage". This estate mansion was a large two storey building. It is hard to determine what the first floor looked like because the front and sides were hidden by a large, covered porch supported by many posts. The windows of the second storey were slightly round-arched and flanked on both sides by painted, wooden shutters. The roof was slanting and overhung the eaves. The chimneys were clustered and ornamental in design.

"The Hermitage" burned in 1936 but was partially restored by Mrs. Dick-Lauder who lived there until her death. Today the ruined wall of "The Hermitage" on Mineral Springs Road

still reflects something of the past grandeur of this estate.

No. 362 Wilson Street was built in 1820 by Job Lodor as his home. During the R bellion of 1837, Colonel Denniston billeted some 500 troops in this village, some of which were placed in the Lodor home. There were places under the stairs and floor for hiding ammunition and artillery.

Originally, it was a clapboard house in the colonial style. "...The gable false front of the second storey was added about a century ago. The quaint porch has been replaced by a more modern design."¹³ The windows of both stores were shuttered and placed symmetrically - three on each side of the central focal of the house (front entrance). The clapboards of the previous style have since been obscured by 20th Century stucco.

HISTORIC CHURCHES OF ANCASTER

At Wilson and Halson Streets on the south side stands St. John's Anglican Church. This land was sold in 1824 by George Rousseau to the Reverend Ralph Leeming and a committee appointed to build the Ancaster Free Church. The first church was a white frame construction with large Gothic windows. The square white tower was surmounted by a spire. This church was built in unison by the Anglicans and the Presbyterians in the years 1824, 25 and 26. But arguments arose over the use of the church. Mr. Job Lodor loaned the Anglicans money to purchase the Presbyterians share in 1828. However, the church burned on February 27, 1868. Only the Sunday School next door was saved. The corner stone of the present church was laid May 5, 1868 and the new church was

¹³ Ancaster's Heritage, p. 74.

first used on May 9, 1869.

The new church was built of quarried limestone locally collected. It resembles an English parish church with buttresses and a square tower. Some of the architectural refinements of this fine building are the finials which top the square tower, the trefoil windows in the square tower and the double-hung Gothic-styled windows.

St. Andrew's Presbyterian Church was founded in 1830 by the Reverend George Sheed, the first resident Presbyterian minister in Ancaster Village. The first St. Andrew's Church was moved about 1874 to an adjacent lot but burned in December, 1879. The present church was built between 1873 and 1875. The church bell is from the first church and is dated 1835. It is now the only thing remaining of the original church. The present church is a fine stone building with a square tower on which is mounted a spire. The windows are large and round-arched. The tower is encircled by two balustrades, one at the base of the windows and one above them.

ANCASTER BUILDINGS BEFORE AND NOW

"On May 16, 1870, a By-law was passed by the Ancaster Township Council to buy an exhibition ground and land for a Township Hall..." The Hall was officially opened on December 28, 1871.

The Hall was, and still is, a handsome and dignified building. The entrance is most impressive. The porch is in the Gothic tradition with clusters of solid oak pillars at each side of the stairs. It was heated by a large pot-belly stove situated

near the entrance and was lighted with oil lamps in chandeliers. This building was used in varied ways for: council meetings, elections, suppers, theatrical shows, church entertainments and even fall fairs.

When the new Hall was built in 1966, a group of enthusiastic Ancastrians formed a committee called A.C.T.I.O.N. (Ancaster Citizens To Improve Our Neighbourhood). This group raised the money and helped with the work needed to restore the old Hall to its original beauty and former elegance.

In 1832 George Rousseau issued Jacob Kramer to build what is today the front half of local quarried stone of the Union Hotel at 386 Wilson Street and Academy Street. It burned down in August, 1878 and only the exterior walls were left. In 1879 the hotel was rebuilt. The original walls were used but the building was doubled in size with a rear addition. This was also made of stone. The junction of the two sections can still be seen. It was used as a hotel until 1950 when Miss Florence Cope purchased it and converted it into apartments.

HISTORIC ROADS IN ANCASTER

There was once a road (the Mohawk Trail) coming from Grimsby crossing Wilson Street at the foot of the Village of Ancaster. It headed west to join up with the Mineral Springs road near The Hermitage Lodge in lot 42/2. From there it went west to Cainsville. "The portion of the Mohawk Trail which has disappeared, between Ancaster Village and Lot 42/2, used to continue from the present Mohawk Trail at the corner of Wilson Street, down the old road to Dundas for about 200 yards to

present day Ontario Street, a short, dead end street that runs westerly from the Old Dundas Road. It then followed an almost bee-line course from Ontario Street to the Hermitage Lodge, diverging slightly here and there in order to follow the contours of the land. This gave an almost level road bed; but, since it never was stoned, there are few if any traces of its route today.¹⁶

Ontario's first Lieutenant Governor, John Graves Simcoe, realized that American rebels would one day attempt to capture Canada. Therefore, he ordered the construction of two military highways for the transportation of men and supplies. These were Dundas Street and Younge Street. Dundas Street connected Lake Ontario via Coote's Paradise and Burlington Bay, with Lake Erie via the Grand River, and also with Lake St. Clair, via the Thames River. Today this road is called Governor's Road by those in and around Dundas while in Woodstock and Paris it is still called Dundas Street.

A LOOK AT HISTORIC PRESERVATION IN ANCASTER

The people of Ancaster have tried to preserve and restore their heritage. They have bought old mills and homes and restored them to their former elegance. They have a great deal of pride in their ancestors. Great care is taken of the old buildings and even of the ancient tombs in the cemeteries and family burial grounds.

The Old Town Hall still stands in its original splendour. Ancastrians have done much to save relics such as this while Hamiltonians have allowed old buildings like the Old City

¹⁶ Ibid, p. 212.

Hall to be torn down. Little apathy does exists in Ancaster. When the Old Town Hall was to be demolished, the citizens formed a delegation to preserve it. Today all can see progress and history as they view the Old and New Town Halls.

Ancaster should be proud of its heritage and those who have fought to save and hold onto it.

BURLINGTON

The town of Burlington is situated near the southwestern end of the Hamilton-Toronto section of the Iroquois Plain. This plain supplied the early settlers with not only the basic necessities of life but also the means to create a thriving community.

The area was inhabited by three Indian nations, the Hurons, Iroquois, and the Algonquins. By the end of the American War of Independence when the first United Empire Loyalists came to Upper Canada the Neutral Indians had left the area. The Iroquois, after defeating the Algonquin and Huron tribes, turned their attention to the French and battled fur traders and settlers for the next ten years. The Indians realizing they were fighting a losing battle gave in ultimately. Eventually the Mississauga tribe appeared in Halton County. The Mississauga Indian territory lay between Burlington Bay and the Humber River extending as far north as Lake Simcoe.

These Indians were a peaceful tribe, even managing a friendly relationship with the Iroquois. In 1796 the Mississauga tribe sold land adjacent to the Grant River to the Six Nations Grand River Council. When the government was negotiating with

the Mississauga tribe for land acquisition along Lake Ontario from Burlington Bay eastwards, the Mississauga adopted Joseph Brant, the leader of the Six Nations, as their chief. Brant's tribe were allowed to occupy land at Burlington Beach provided they did not hunt or fish on Mississauga land. John Graves Simcoe, the first Governor of Upper Canada, also honored these land rights of the Mississauga. Settlers and Indians alike used the Indian trails.

After an agreement was reached in 1806, the Mississauga land between the Humber River and Burlington Bay was purchased by the colonial government. Gradually, the Indians dispersed, some going with the Algonquins east of Montreal and others joining the Six Nations at their settlement on the Grand River.

PRESERVATIONS AND ARCHITECTURAL CONSERVANCY IN BURLINGTON

A few ancient homesteads of early settlers are still standing in the Burlington area. One of these is the Joseph Ireland home built between 1835 and 1837. The house stands near Dundas Street on the west side of the Guelph Line. The style is typical of a country squire's home. It is a large and wide two-storey structure with four fairly large windows on each storey of the facade. The roof is a sloping one, and there are two large chimneys which previously led to fireplaces. A covered porch supported by about nine white-washed posts runs the entire front of the building, and the main entrance is flanked by white-washed pilasters. Today this home stands north of M. M. Robinson High School and is still occupied by an Ireland. It is considered to be the oldest house in Burlington.

The S.S. No. 5 school house was built about 1872 on land sold by Peter McCulloch. This fine red brick school house was built just slightly north of the east side of Guelph Line. The building was used until 1951, but stands vacant today.

In 1877 a hotel known as the Nelson House was built in what is today known as Burlington. It stands on the southeast corner of Dundas Street and the Guelph Line. The building is a large square two storey edifice made of stone quarried from the local area, the roof and windows forming part of its fine architectural features. The numerous windows are rectangular in shape and are topped by stone lintels. The front entrance is a round-arched door topped by a round lintel. Today the building is no longer a hotel but a private residential dwelling.

One of the oldest surviving buildings in Burlington is the commercial structure at the north-east corner of John Street and Lakeshore Road. It was built well over a century ago by the town's first reeve, John Waldis. At that time it was used as a store retailing dry goods, groceries, and hardware. The building is of fine stone, the roof being slanted. The chimneys are clustered and the eaves bracketed in a decorative fashion. "A feature of this old building was a windlass 13 feet in diameter held together with square-headed nails which was used to operate a hoist by which grain was hauled up."¹⁷

BURLINGTON HOMES BEFORE AND NOW

The first homes in this area were log cabins erected after part of a forest was cleared. Later, frame houses of logs

¹⁷ Ford, Barbara; Emery, Clair; *From Pathway to Skyway*, Burlington 1967, p. 157.

were built. In 1825 Peter Fisher settled into a log cabin with his bride. It was built on the 200 acres which his father had purchased from Catherine Brant, Chief Joseph Brant's daughter. Shady Cottage, the Fisher home, was constructed on this site in 1837. This is an elegant stucco house with a mansard roof supporting dormer windows. The most impressive architectural feature is the front porch, which is large, covered, and projecting. The decorative touches on the porch are Italianate, and can be seen in the treatment of the balustrade which crowns the roof of the porch, circles the columns supporting the roof and also encircles the floor. This fine home still stands at 801 Guelph Line.*

Another beautiful home is the Lakehurst Villa at 3074 Lakeshore Road. It was built for W. D. Flatt, a lumber merchant, about 1910. The roof is low, slanting and red-tiled. The second storey is of stucco and the first of cobble-stone. The wall surrounding the gardens is also of cobble-stone and the home is surrounded by lavish gardens and tall old evergreens.

Today, Burlington is a residential suburb rapidly being filled with high-rise apartments, town houses and condominiums; times have changed greatly from the days of the Indians and early settlers.

BURLINGTON CHURCHES AND OTHER BUILDINGS

St. Luke's Anglican was one of the first churches built. It was erected in 1834. The building is of white frame construction with arched windows and doors. The front entrance projects from the main building, and a trefoil window is seen in

* The Fisher home was recently destroyed - The Editors.

the apex of the gable. The church is surrounded by acacia trees planted in 1840 by a Mrs. Greene.

Knox Presbyterian Church stands at the same site where its founders worshipped in 1845. In 1845 a plain frame church was erected at James and Elizabeth Streets. In 1877 a new sanctuary was added. The original building was moved a few yards east and was later brick-veneered. The church entrance on Elizabeth Street was built in 1910 to hold a new stained glass window donated to the church. Gothic in style, the building has double-hung arched windows with steep gables and bracketed eaves. A trefoil window has been placed in the apex of the gable in the main section of the church.

Burlington's old Town Hall was once the Temperance Hall. It was a brick building with a projecting front entrance. The windows are long and rectangular in shape. The roof is slanted and perched on top is a finely decorated, square tower. After 1907 the old town hall on Elizabeth Street was sold to the Boy Scouts.

DUNDAS

Dundas is called the Valley City. It took its name from the military highway opened by Governor John Graves Simcoe and named after his friend Henry Dundas (Viscount Melville).

In earlier days, Dundas was an aspiring town. Through the Desjardins Canal scheme, the citizens of the town hoped that their port would be one of the busiest along the shores of Lake Ontario. Great warehouses lined the shore where grain and other products were stored ready for shipment.

The first homes in Dundas were log cabins but later many rough cast or stucco houses were built. Later still, frame, brick or stone homes were erected.

PRESERVATIONS AND ARCHITECTURAL CONSERVANCY IN DUNDAS

About 1840 building materials were made available from the new brick yards and the stone quarries in the area. Hence, many large buildings were erected around this time. One such building was the North American Hotel, better known today as the Collins Hotel.

In November 1840 Bernard Collins started building his new "North American Hotel" and a year later he moved in. It was destined to set a record as the longest operating hotel in Ontario. As the Collins Hotel it is still operating. Today it is under the proprietorship of Mr. H. Gordon Smith.

The hotel is a large two storey building. The front entrance is protected by a covered porch. The roof is supported by large, white columns and encircled by a balustrade.

In 1848 Hugh Moore built "Mount Fairview" a beautiful southern style mansion. Situated on the Cotton Mill Hill it overlooked the town. It is a large two-storey stone edifice which incorporates most of the fine architectural refinements of its day. The house is symmetrical; the windows on each side are rectangular in shape and framed in white. The four classical columns are Ionic in style and reach up above the second floor. A balustrade encircles the porch of the second storey and another balustrade tops the building. On the roof is perched a belvedere. On each side of the house is a project-

ing covered porch supported by columns, similar in style to those of the facade of the building. Mount Fairview still graces the Cotton Mill Hill as it did many years ago and it is a monument to a fine citizen.

CHURCHES AND OTHER BUILDINGS IN DUNDAS

The Blue Stone Church at 280 King Street was erected in 1846. The building was of bluish colored limestone brought from Kingston. It was a square building with a slanted roof upon which was perched a small tower. The front entrance which was plain in design gave the overall effect of simplicity. Later, the building served as the office of Cockburn Lumber Company, but today it is the Canadian Legion Hall.

A wooden tavern was erected in 1841 by Moses Weaver on King Street opposite Miller's Lane. It was first called Weaver's Tavern, but acquired many names afterwards - the Terrapin Saloon, the Red Lion Hotel, the Queen's Hotel, the Osborne Hotel and the Wentworth Inn. In September 1871 when it was known as the Terrapin, it burned but was at once rebuilt in its present day form. A feature of the present edifice is the arched passageway (once known as "The Recess") located through the centre of the building from front to rear. In early times horses and wagons were driven to the stables via the passageway.

The Merchant's Exchange Hotel opposite the Town Hall on Main Street was built by Ben and Sam Overfield in 1847. It continued as a hotel until 1868 and was sold in 1872 to the Union High and Public School Board who established it as an auxiliary school. Later it was used as a grocery store and a carriage

factory. Since 1961 it has been the headquarters for the Independent Order of Odd Fellows in Dundas. Its architecture is worth mentioning. The wide eaves are supported by massive beams that project through the walls to the edge of the roof. The doors in the middle front of the second and third floors once held half oval fanlights above. The third floor still possesses this unique feature. It is thought that at one time there were second and third floor verandahs. The front windows of the upper stories each contain thirty panes of glass. The side windows of the second and third floors have twenty-four panes apiece. It was indeed an elegant building.

CHAPTER NINE

TRANSPORTATION

john davis

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INTRODUCTION

This study is concerned with transportation in the Halton-Wentworth area with the City of Hamilton as the focus. The first part examines the existing ground transportation system, its problems, and the proposed plans for its improvement.

The second part is an investigation of the Mount Hope Airport controversy examining the reports that oppose and support expansion of the airport facilities to become the fourth largest airport in Canada.

The third section deals with rapid transit, and compares it with transportation by private automobile.

The final part is a list of some recommendations on transportation and transportation planning.

Since total objectivity is practically impossible, no attempt has been made to separate this report into objective and subjective sections. Throughout the report comments will be made on plans and planning procedures.

GROUND TRANSPORTATION

The City of Hamilton with nearly 300,000 people is one of Canada's major industrial centres. Because of these two factors, transportation is an extremely important facility.

The most common mode of transportation is the automobile.

To accomodate this Hamilton has 512.4 miles of roads¹ which if laid end-to-end in a straight line would reach from Hamilton to Quebec City. Even so, Hamilton has a large traffic congestion problem. One of the primary causes of this is the compact nature of the central business district (CBD) restricted by the Niagara Escarpment.

In a study done by CHCH-TV,² it was found that in a 24 hour period 287,000 people entered Hamilton's CBD (bounded by Hunter, Queen, Cannon and Wellington Streets): equivalent to almost the entire population of the city. This, coupled with the fact that less than ten percent of those entered by public transport (bus) creates much of the traffic congestion.

To alleviate this and to ease congestion in other parts of the city, Hamilton has utilized, more so than most major urban centres, one-way streets. By transforming two two-way streets into two one-way streets, each going the opposite way, the traffic capacity has been doubled.³ However, Hamilton's one-way streets are swiftly approaching capacity.

The major cause of CBD congestion is the presence of through routes in the downtown area. The city has attempted to divert the traffic. Plans to do this were drawn up by traffic engineers planning with a single perspective. Although the plans may be sound from the viewpoint of traffic, they seemed to fail to take aesthetic, human, social and environmental factors into account.

The major East-West route through Hamilton is Highway 8 (Main

² CHCH TV Traffic Feature, June 16, 1971.

³ *Ibid.*

and King Streets). This corridor carries through traffic into the downtown core. To ease the resultant congestion, Cannon Street has been made one-way eastbound to act as a downtown bypass. From the standpoint of the traffic engineer, this eases the pressure on Highway 8; however, living conditions on Wilson Street (the extension of the downtown bypass) have greatly deteriorated due to the noise and air pollution caused by the large number of trucks now using a formerly residential street. Enraged citizens have on occasion blockaded the street in protest.

The major rush-hour route which carries residents of the Mountain (that part of the city above the Niagara Escarpment) to and from the industrial district is the James Street - John Street route. It also passes through the downtown core, creating focal points of congestion, especially in the morning and evening rush hour periods. The city's answer to this is the Claremont access which links Victoria Avenue and Wellington Street with Upper James Street and West Fifth Street, thus bypassing the CBD. Here again a hidden cost emerges, unforeseen by the traffic engineer, in the form of an almost complete defacement of that part of the Niagara Escarpment which is visible from the centre of Hamilton.

Had environmental and aesthetic considerations been taken into account before construction of the Claremont access, it is questionable whether it would have been considered desirable or necessary. Beckett Drive connecting Queen Street with Garth Street performs the function of climbing the Escarpment and it is a picturesque drive. Claremont, on the other hand, is barren and ugly with its bare exposed rock and metal retaining walls. Obviously, any suitability for wildlife and plant habitats has been destroyed.

Hamilton also has two expressways in the planning stages: the Mountain Freeway and the Redhill Expressway. The Mountain Freeway will traverse the mountain in an east-west direction just south of Limeridge Road from the Mohawk Road - Highway 403 interchange to Albion Falls. The Redhill Expressway will follow the Redhill Valley in the city's east end from the Queen Elizabeth Way to the Mountain Freeway (see figure 1). The Mountain Freeway may be extended east to the Saltfleet satellite city and the Redhill Expressway may be extended south-west to Nanticoke.

The proposed construction of these expressways exhibits yet another omission in the planning variable selected -- human-social considerations. The Redhill Expressway will destroy the recreational potential of the Redhill Creek valley, and will eradicate one of the city's few remaining natural areas. It will be similar to the Chedoke Expressway (Highway 403) which obliterated the Chedoke Creek valley and Ainslie Wood, the latter being a beautiful wilderness park now paved over.

The Mountain Freeway, visualized by Commissioner of Planning Robert Bailey as the "backbone" of the mountain,⁴ poses a hidden danger to community development. If, as Mr. Bailey suggests, the area to the south of the freeway becomes as populated as that to the north, the upper city of Hamilton above the Escarpment will be sliced in half by the expressway, isolating the area to the south by limiting the number of crossovers, and thus ease of access back and forth. As the distinguished American urbanologist Lewis Mumford wrote, "Highway planners have yet to realize that these arteries (expressways) must not be thrust into the delicate tissue of our cities; the blood they circulate must rather enter through an elaborate network of minor blood vessels and capil-

⁴ Bailey interview.

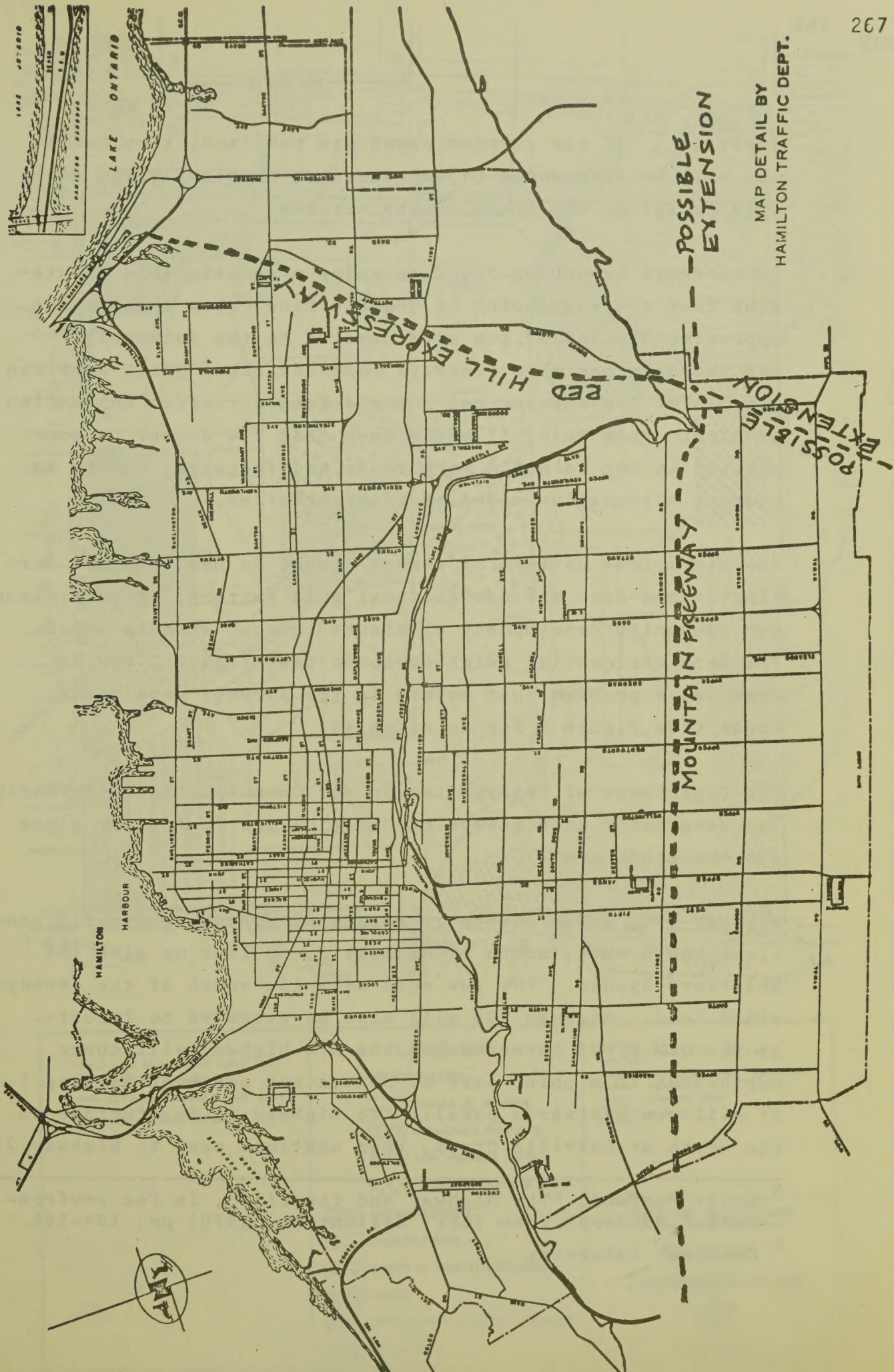


Figure 1 PROPOSED ROUTES OF THE MOUNTAIN FREEWAY AND RED HILL EXPRESSWAY

laries.⁵ If the current plans are realized, then Hamilton will be surrounded by expressways, physically and socially isolating the areas on the outside.

Expressways have been found to enjoy a questionable reputation from the standpoint of traffic flow. Los Angeles has approximately 46% of its area devoted to the automobile⁶ and probably has more freeways than any other North American city. Yet Los Angeles has a world-famous traffic congestion problem. From this, it would seem that the answer to congestion is not to build more roads and freeways, but to encourage alternative modes of transportation.

The historical pattern of street layout in Hamilton and Burlington has been the conventional grid pattern. Future plans for community development eliminate through streets which fragment residential neighbourhoods (see figure 2 for an example) a problem that exists in the already developed areas (see figure 3 for an example).

The Department of Transportation and Communications (formerly the Department of Highways of Ontario) has four major plans for the study area.

Highway 403, which currently merges with Highway 2, will continue south west, north of Highway 2, to link up with the Brantford bypass. The new road will lie south of the Jerseyville Road. Highway 403 will also be extended to Toronto. At the QEW - 403 interchange, the new highway will curve northwards to a point east of Nelson and north of Highway 5. It will run eastwards parallel to Highway 5, jog further to the north at Oakville Creek, then continue east to Highway 27.

⁵ Lewis Mumford, "The Highway and the City", in *The environmental Handbook* (New York: Ballantyne, 1970) pp. 184-185.

⁶ Heintzel interview

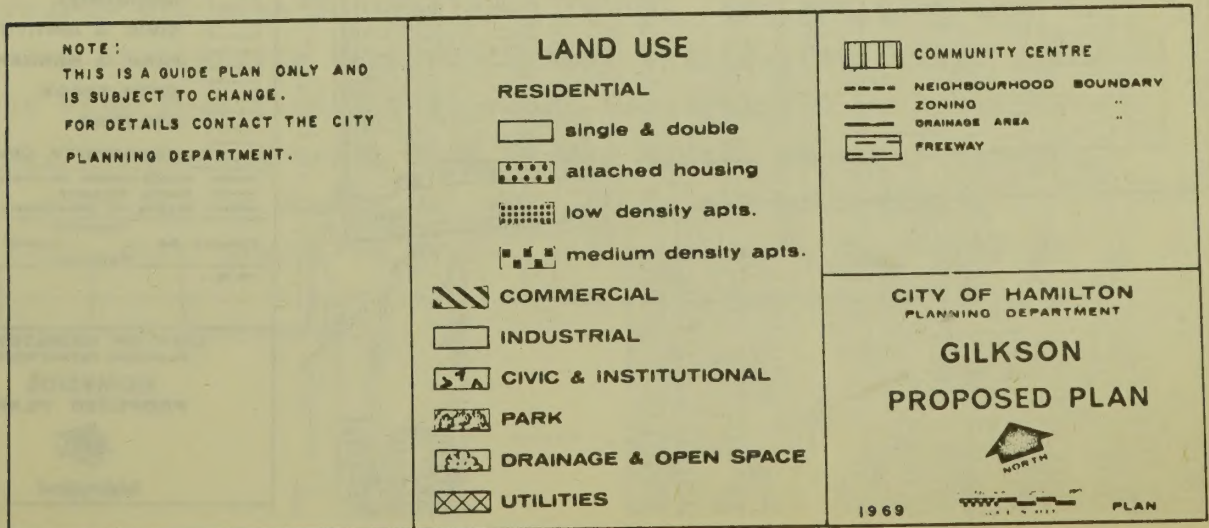
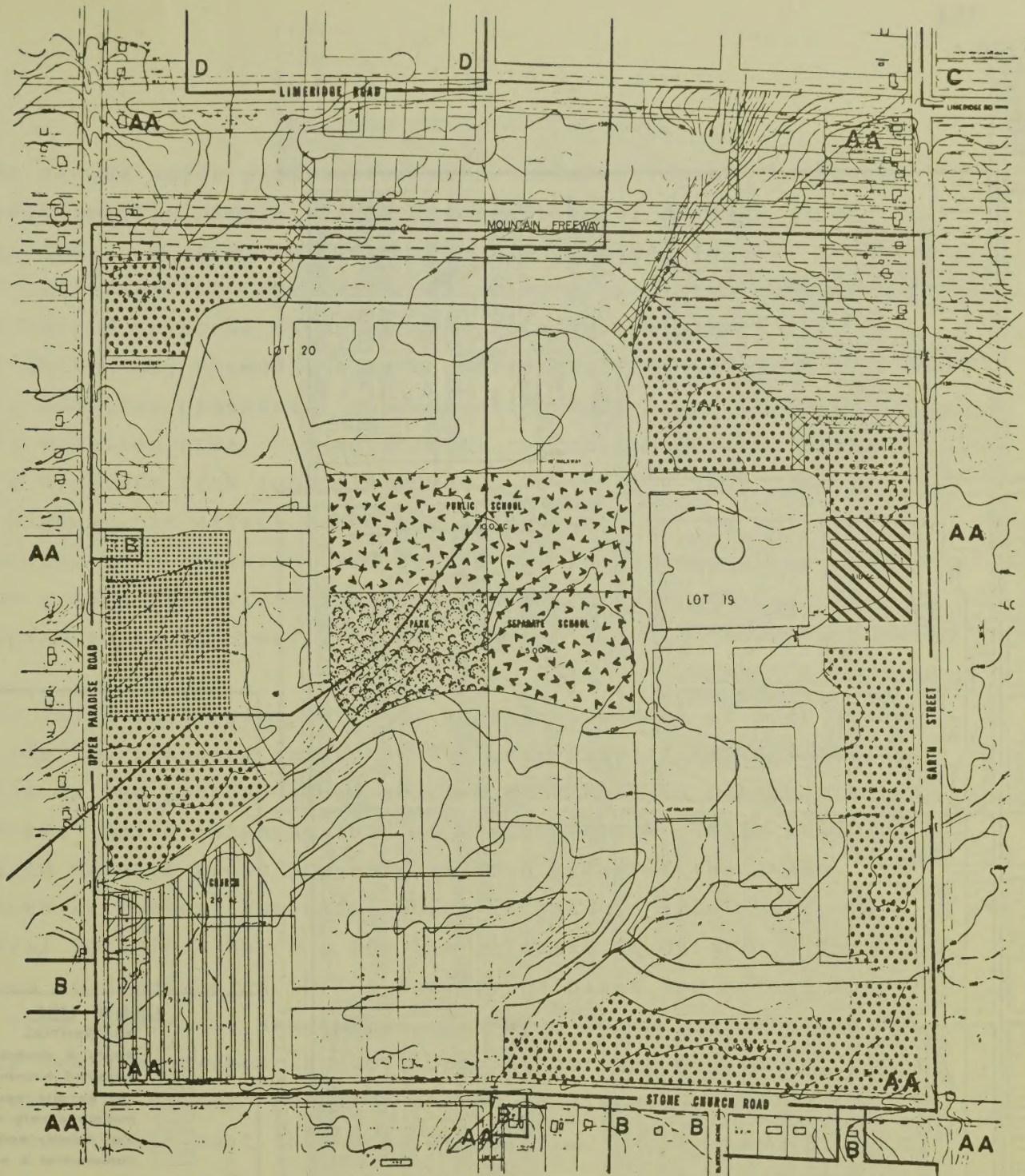
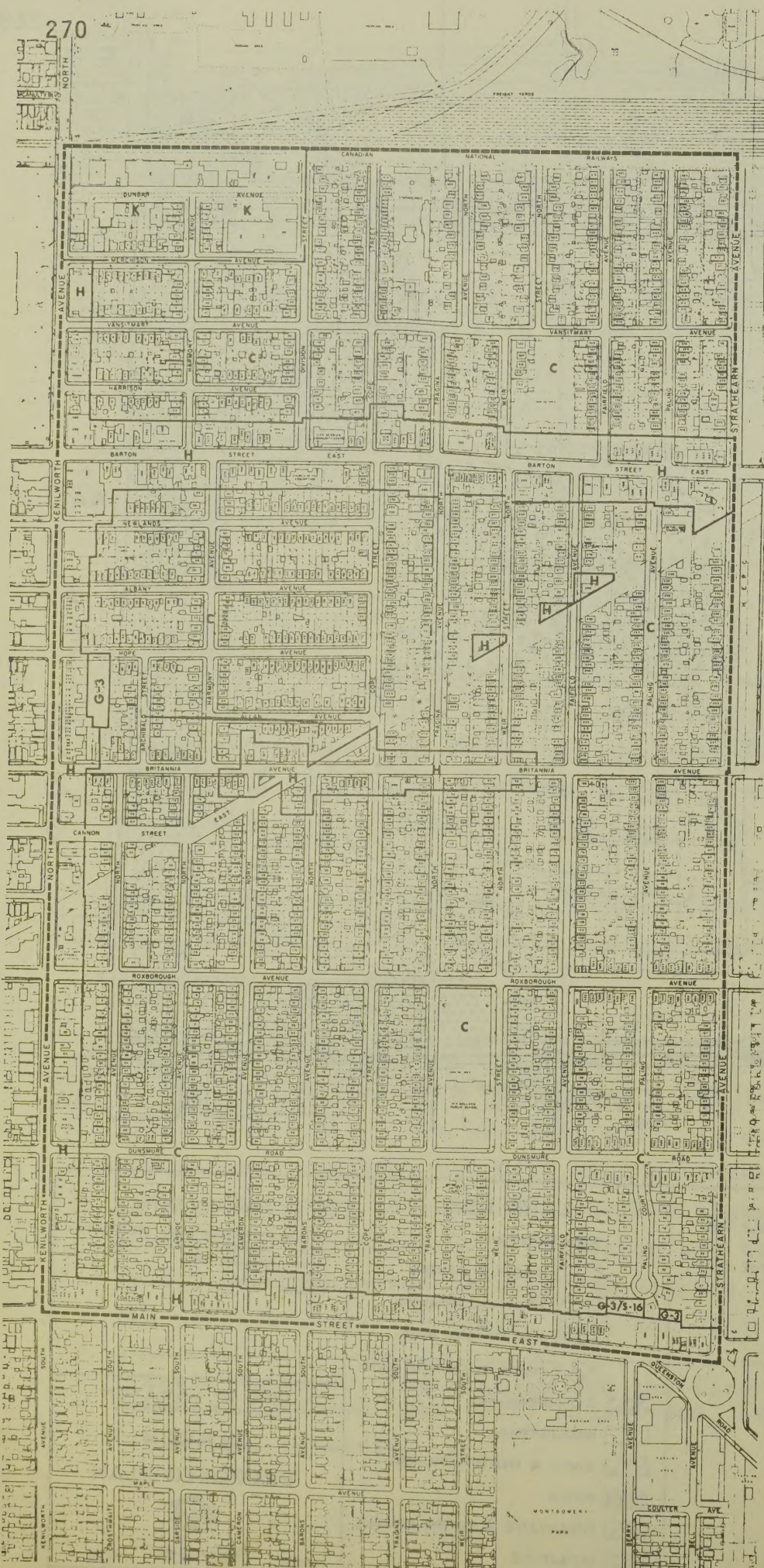


Figure 2 FUTURE RESIDENTIAL ENCLAVES PROPOSED FOR HAMILTON



LAND USE

	RESIDENTIAL single & double attached housing low density apts. medium density apts. high density apts. commercial & apts.
	COMMERCIAL INDUSTRIAL CIVIC & INSTITUTIONAL PARK & RECREATIONAL OPEN SPACE UTILITIES COMMUNITY CENTRE

Neighbourhood Boundary

Zoning Boundary

Staging of Development Boundary

Approvals

Planning Bd.	Council	Revisions

CITY OF HAMILTON
PLANNING DEPARTMENT
HOMESIDE
PROPOSED PLAN

NORTH

1:10,000

Figure 3 RESIDENTIAL DISTRICTS FRAGMENTED BY THROUGH ROUTES

The second major plan calls for an elimination of the Stoney Creek traffic circle at the intersection of Highway 20 and the QEW. To carry this out, the DTC intended to take 14 acres of Confederation Park before the City of Hamilton made an alternate proposal in an attempt to save the park. The DTC, in this case, showed the same overspecialized planning as the Hamilton planners. Confederation Park is a rarity in the Hamilton area -- a waterfront recreational park, attracting visitors from long distances. To destroy this park for a highway, in effect makes man subordinate to the automobile. But the main criteria used by the DTC to determine the need for a road are origin and tube counts.⁷ Environmental factors appear to be ignored.

The third major plan reflects another instance of poor transportation planning caused by the over-simplified specialist; this is the proposed road to link York Road in Dundas with Cootes' Drive (Highway 102) at Spencer Creek. This road would have to cross property on both sides of the swamp known as Cootes' Paradise, which is held in trust by the Royal Botanical Gardens for the citizens of Ontario. This area is outstanding in its variety of plant and animal life, a true wilderness sanctuary. The need for a road through its western reaches is questionable, but the necessity of preserving Cootes' Paradise cannot be disputed. Under no circumstances must this road be built.

The fourth DTC plan for the area is the straightening and widening of historic Governor's Road (Highway 99) which links Dundas with Brantford. This road, commissioned as a military road by Governor-General John Graves Simcoe of Upper Canada, winds through the Dundas Valley. It is one of Southern Ontario's most beautiful areas, and Governor's Road provides

⁷ Fitzgerald interview.

travellers with an excellent drive through its rolling hills. The proposed extension of Highway 403 to Brantford will very shortly provide a fast route west from Dundas. To widen and straighten Governor's Road is not only unnecessary, since a more than adequate alternate route will soon exist, it's tragic since an aesthetically-valuable wilderness and farming area will be defaced, to say nothing of the destruction of a road unparalleled in historic value and dotted with historic buildings.

MOUNT HOPE AIRPORT

Mount Hope is a small community, south of the City of Hamilton on Highway 6. The airport here is currently the centre of a controversy, with the Chamber of Commerce and the Hamilton Economic Development Commission supporting expansion of the facilities to allow it to become the fourth largest airport in Canada. Opposition to expansion is spear-headed by the Hamilton Federation of Environmental Groups. To deal with this, let us examine briefly the reports issued by the two groups.

The move to expand the airport was begun with the preparation of the *Preliminary Report on the Probable Effect of the Possible Expansion of Mount Hope Airport*, sponsored by the Hamilton Economic Development Commission. Dated April 17, 1970, this report concluded that expansion of Mount Hope Airport:

- "(a) will significantly increase the rate of industrial growth in Hamilton;
- (b) will lead to a diversification of Hamilton Industry;

(c) will provide direct and indirect additional employment."⁹

The report made many sweeping generalizations that are difficult to prove, and are of questionable validity, such as "no community can grow and diversify without an airport"¹⁰ and Hamilton is experiencing a "relative decline as a population and industrial centre."¹¹

The report contradicts itself in several places. While it claims that expansion of the airport is necessary for economic development, it admits that airports in London, Ontario and Fredericton, New Brunswick had no effect on the pace of development.¹² Also, the report claims that "by 1985, with no major intervening factors such as the development of Mount Hope Airport . . . Hamilton will have lost whatever remains of its present attractiveness as a site for new industry and development".¹³ Later, however, the report admits that Hamilton's attractiveness to industry has been its "bulk shipping advantages of rail and water transportation."¹⁴ Even without these facilities an airport would be of little value since air transportation is not suitable for bulk shipping of raw materials or manufactured goods on a large scale as is rail and water transportation.

This preliminary report was followed by a second and larger report *A Study of the Impact of Expanding Mount Hope Airport* also sponsored by the Hamilton Economic Development Commission.

⁹ Isbester, A.F., *Preliminary Report on the Probable Effects of the Possible Expansion of Facilities at Mount Hope Airport*. (Hamilton: McMaster University, 1970) p. 1.

¹⁰ *Ibid.*, p. 2.

¹¹ *Ibid.*, p. 13.

¹² *Ibid.*, p. 2.

¹³ *Ibid.*, p. 7.

¹⁴ *Ibid.*, p. 8.

The findings of this report are as follows:

1. At current domestic users demand, metropolitan Hamilton can support a full-service, Department of Transport (D.O.T.), regional airport.
2. Such a facility would provide significant relief for Toronto International Airport.
3. Future domestic demand will easily support this facility.
4. A full-service D.O.T. airport will have a substantial economic impact on the Hamilton metropolitan area.
5. Expansion of the Mount Hope facilities to a full service, D.O.T. airport will have little or no deleterious effect upon surrounding land uses.
6. Pollution measuring devices should be installed at key positions in the airport vicinity to monitor major pollutants so that, if necessary, the utilization of the airport can be carefully controlled.
7. The impact of an airport is the same as that of any other major transportation facility; therefore, it must be integrated with the land use and community plans." 15

The report deals with the major problems connected with airport development, examining noise, safety, and air pollution. Noise was considered unimportant since "engineering achievement will undoubtedly reduce the sound level by 1975 an additional 3 decibels which . . . is a reduction of the overall sound level by 50%." ¹⁶ It seems that if Mount Hope supports more flights, which of course it will if expanded, then the absolute amount of noise generated would increase even if individual aircraft become quieter.

By pointing out that the major zone in which aircraft may crash is "the approach zone and close to a projection of the centreline of the runway", ¹⁷ the report brushed aside safety as a problem by claiming that the reorientation of the runways

¹⁵ A.F. Isbester, et. al., *A Study of the Impact of Expanding Mount Hope Airport* (Hamilton:McMaster University, 1970), p.1.

¹⁶ *Ibid.*, p. 16.

¹⁷ *Ibid.*, p. 17.

would minimize the number of people in the approach zone.¹⁸ The authors must have forgotten that they expected commercial, industrial, residential and even recreational development to spring up all around the airport. All of these would attract many people.

One of the report's less credible statements is "In view of the low percentage utilization of the proposed extensions to Mount Hope Airport air pollution effects are not believed to be an important factor."¹⁹ This statement was made despite the fact that the exhaust from one jet roughly equals the exhaust from 1,000 automobiles²⁰ and the fact that, if the report's recommendations are implemented, Mount Hope would be among Canada's top four airports, hardly "low percentage utilization".²¹

Following these reports, the Hamilton Federation of Environmental Groups sponsored an alternative economic *and* environmental assessment of the impact of expanding the airport, using a set of assumptions on employment, income, and industrial development that were believed to be more realistic than those used in the H.E.D.C. reports.

This report, *Mount Hope Airport: Economic and Environmental Implications of Proposed Expansion*, was written by three McMaster University faculty members, Prof. Sam Lanfranco, Dr. Robert Korol, and Dr. Ross Hall, along with Meteorologist Floyd Elder, Citizens' Committee for Pollution Control member Robert Clark, and Mrs. Valanne Glooschenko, biologist.

¹⁸ Ibid.

¹⁹ Ibid., p. 20.

²⁰ Paul Grescoe in *The Canadian Magazine*, April 4, 1970, p. 15.

²¹ A. F. Isbester

The conclusions and recommendations of this report are as follows:

SUMMARY OF FINDINGS

The expansion of Mount Hope Airport as proposed by the Hamilton Economic Development Commission has been studied from the viewpoints of economics, air pollution, noise pollution, high speed ground transportation, regional land-use planning, and environmental quality. The results of these studies are presented in this report. The following is a summary of the principal findings and resulting recommendations.

Economics

1. An expanded Mount Hope Airport would not be expected to bring substantial industrial development to the Hamilton area. Studies have shown that industry is attracted primarily by high quality ground access and serviced land, not by air transportation facilities.
2. Airports tend to have negative effects upon adjacent residential property values, produce noise and air pollution, and concentrate benefits among a small class of airport users. To suggest that users pay a slightly higher cost for air travel in the form of longer travel time to the airport site, and that the non-users be spared the direct and indirect costs of having an airport located nearby is consistent with the general consensus that the user of a service should pay and the non-user should not have to pay.
3. Airport expansion will probably have a negative influence upon the prospects of developing an inter-urban rapid transit system for the Hamilton and Southern Ontario region. With the operating expenses of the airport the region would be less able to support the investment necessary for other forms of public transport.
4. Any industry which made purchases in the local area would, dollar for dollar, have the same effect as the airport. Indirect job and income effects are therefore not unique to an airport operation.

Pollution

1. Aircraft release a substantial amount of pollutants during landing, taxiing, and take-off.

2. The Mount Hope Airport site is located close to and up-wind from Hamilton. The local meteorological pattern is such that pollution generated from the airport site will add directly to the over-burdened air envelope surrounding the Hamilton area.
3. Relationship between urban air pollution and mortal disease has been established. Recent studies are particularly disturbing because they demonstrate the synergistic effects of combinations of air pollutants.

Noise Pollution

1. A majority of the population of 105,000 presently living in the Hamilton mountain area would be affected, many of them seriously.
2. Normal holding and circling patterns would be an annoyance to people in Ancaster and Brantford.
3. Without special sound proofing facilities to protect indoor environments, interference with performance and efficiency of work is expected in the areas affected. In addition, sound medical studies indicate definite relationship between high noise levels and increased physical and possibly mental illness.

Mass Transit As An Alternative To Airport Expansion

1. Transportation experts view high speed ground transit as the preferred future mode of transportation between major cities less than 500 miles away. A network of new airports, however, is contra-indicated because of air pollution and congestion.
2. Mass transit facilities will be required within the near future, and provisions for rights-of-way should be made now.
3. Costs of expanding Mount Hope, or of installing a high speed ground transit system through the Nanticoke-Hamilton-Toronto corridor, are roughly comparable.
4. Air facilities to serve the Niagara region should be located on submarginal farm land within reasonable access to the major urban centres in the region. These population centres include Brantford, St. Catharines, Niagara Falls, Hamilton, Welland, and the three new urban centres now being proposed for the Haldimand-Norfolk area. Mount Hope, immediately south of Hamilton and surrounded by prime farmland, does not meet these qualifications.

Development of the Mount Hope site would cause duplication of air facilities, because other urban centres would pressure for another more *central* airport.

5. Expansion of the Mount Hope site would create a bias against rapid transit. With a regional airport in place, rapid transit serving the Nanticoke-Hamilton-Toronto corridor would look less attractive. Major highway access to serve the airport would further bias the decision against future rapid transit.
6. Given the predicted rates of population increase in the Niagara region, rapid transit will be needed because it is environmentally preferred over duplication and congestion of air facilities.

Overview - Mount Hope and Regional Land-Use Planning

1. The Lithwick report, an urban study commissioned by the Canadian government, places Hamilton among those major centres which will experience severe problems in terms of population and transport. Population projections indicate 500,000 by 1981, and 1,201,000 in 30 years. Developing the fourth largest airport in Canada so near present city limits can only increase the city's problems of congestion, noise, and pollution.
2. The Provincial Government's blueprint for planning, the *Design for Development for the Niagara (South Ontario) Region*, has designated the protection of prime farmland from urban development as an environmental priority. A high percentage of Wentworth County, approximately 48%, is rated as Class I and II Agricultural land. Glanford and Binbrook townships those most likely to be used in airport expansion, have even a higher percentage of prime farmland which should be protected from urban and industrial development.
3. *Design for Development* has designated preservation of prime recreational areas as an environmental priority. This is because recreational land must be planned for today, although it could be taken for granted in the past. Development of any major transportation facilities should be closely integrated into recreational resource planning. This planning has yet to be initiated for the Wentworth County areas south of Hamilton.
4. Official Ontario planning policy as stated in the *Design for Development: The Toronto-Centred Region* is to encourage and stimulate growth away from the heavily urbanized Toronto-Hamilton axis. An expanded Mount Hope facility could further concentrate popula-

tion along the axis where it is undesirable. An alternative site, centrally located in the Niagara region and on submarginal farmland, is suggested.

5. Solutions to growth problems caused by urbanization pressures cannot be found in planning perspectives which are *limited by the boundaries of a single municipality*. Any future transportation system must be planned within an integrated provincial framework, if the mistakes of the past are to be avoided. The proposal that Mount Hope Airport become a large regional facility was initiated by the Hamilton Economic Development Commission; it was not called for by a total transportation system to serve the future needs of South Ontario.
6. For too long, North Americans have thought of achievement only in terms of economic growth. Hamilton's many problems await creative solutions, but development of a large airport just beyond the city limits is not a solution -- it is an addition to those problems already existing. Hamilton will reach its true potential when its goals begin, instead, to²² emphasize achievement in environmental quality.

RAPID TRANSIT

Rapid Transit is currently regarded as an answer to the current overemphasis on the automobile. While there are definite plans for highway development to facilitate continued mass use of the automobile, there are only recommendations for mass public transport in the Draft Official Plan of 1970 for the City of Hamilton. This report on rapid transit is simply a proposal, not yet adopted or rejected by City Council.

Rapid transit may consist of any of the following:

- " - Elevated monorail - used in Seattle, with pedestrians reaching it by elevated decks. It needs little ground right-of-way, but is visually obtrusive, particularly downtown;

²² Lanfranco, S. *et al.*, *Mount Hope Airport: Economic and Environmental Implications of Proposed Expansion* (Hamilton, 1971) pp. ii - iii.

- Elevated duo-rail - used in some areas of Toronto, being somewhat bulkier than the monorail, but having a higher capacity. It is also undesirable in built-up areas;
- Surface level - used in Chicago, with lines similar to a railway, but conflicting with pedestrian and vehicle rights-of-way. It is best suited for expressway medians;
- Open cut - similar to where Toronto's subway emerges from the ground. It is partly screened from view and confines noise somewhat, but land requirements are still great;
- Subway - these are superior as far as visual and noise aspects are concerned, but by far the most costly." 23

The city's report listed the following objectives and principles for a rapid transit system in Hamilton:

1. Each and every line should be routed through the CBD area to stimulate its future growth and to emphasize and facilitate its hub function. On existing rapid transit networks in other North American cities, 60% to 80% of all trips have their origin or destination in the CBD.
2. To promote high overall accessibility in the downtown area while at the same time subcentralizing and grouping urban commercial functions, it is desirable to arrange transit paths to intersect in two or three nodes, all within walking distance of one another and within the downtown area.
3. Based on the history and experience of rapid transit networks, the minimum length at which a radial line can realize its full access-creating potential is approximately 7 miles. The fundamental cause ultimately underlying this length is probably the combination of two apparent measures: man's biologically ingrained orientation to the half-mile pedestrian range multiplied by the distance shrinkage factor for rapid transit, rated as 15. Thus, a full diameter line should extend for 14 miles. A minimum of two lines, or 28 overall route miles, is similarly prerequisite for the creation of a focus, and for efficient, city-wide service.

²³ *The Hamilton Spectator*, March 19, 1970, p. 57.

4. An effort should be made to serve all areas of extensive or dense residential development. Most notably this will apply to most of Lower Hamilton and to the as-yet-to-be-developed high-density community centres on the Mountain.
5. Other specific destinations requiring access to rapid transit distribution are the Hamilton Shopping Centre, Mountain Plaza, the harbour industrial area, the mountain industrial park, Gage and Confederation Parks, the Bruce Trail and the Botanical Gardens, Westdale centre, McMaster University, Civic Square, Hamilton Civic Stadium, Mohawk College, and the five city-area hospitals.
6. Peripheral municipalities to be incorporated into the Hamilton rapid transit network include Burlington, Dundas, Ancaster, Stoney Creek, Saltfleet, Waterdown, and Mount Hope.
7. The centres of the preceding communities would function well as line terminal locations, where no suitable highway-oriented shopping centres exist. One regional shopping centre which does exist and would make an ideal terminal is the Burlington Mall on Highway 25, just south of the Q.E.W.
8. The location of a multi-mode transportation centre should be established in the downtown area in conjunction with the rapid transit network.²⁴

Based on these principles, three possible systems are proposed in the report and are reproduced in Appendix I.

A major obstacle to rapid transit construction supposedly is financial. While the Provincial Government has gained much favorable publicity by articulating support for rapid transit, the fact remains that it will fund only 50% of the cost of a rapid transit system, but 50-80% of the cost of highway development.²⁵

A re-ordering of priorities would ameliorate the cost problem. The following statistics are of interest here:

²⁴ City of Hamilton Planning Department, *Rapid Transit* (Hamilton, 1970), pp. 11-12.

²⁵ *The Hamilton Spectator*, August 25, 1971, p. 10.

PROJECT	COST
Skyway Bridge	\$20 million
Chedoke Expressway	\$30 million
Claremont Access	\$14 million
Burlington St. - Industrial Drive	\$12 million ²⁶

These sums could be transferred instead to rapid transit. The problem is clearly one of priorities rather than absolute cost.

In a report submitted to the Federal Minister of Urban Affairs, Robert Andras, by D. J. Reynolds, senior economist with the Central Mortgage and Housing Corporation, it was recommended that rapid transit be free and increased taxes be levied on gasoline and licenses to make rapid transit more attractive.²⁷

It is becoming clear that a choice must be made between autos and mass transit. The private car is a polluter that is responsible for approximately 55% of urban air pollution.²⁸ Some estimates rate it as being much higher, at 80%.²⁹ Part of the responsibility for this lies with the manufacturers who spend \$15 per car on pollution control and \$140 per car for style changes.³⁰ To blame auto drivers for auto pollution is like blaming a rifle for killing someone. The responsibility lies with the person who pulls the trigger.

Pollution from automobiles consists mainly of hydrocarbons, carbon monoxide, nitrogen oxides, sulfur oxides, and lead. All of these pollutants are potentially hazardous to health.

²⁶ CHCH-TV Traffic Feature, June 16, 1971.

²⁷ *Globe and Mail*, July 23, 1971, p. 3.

²⁸ *Ibid.*

²⁹ Charles H. Percy in *Earth Day - The Beginning* (New York: Bantam, 1970), p. 159.

³⁰ *Ibid.*

Rapid transit is not nearly as dangerous in this respect.

Rapid transit would also be more efficient than autos. Travelling by bus is 17 times more efficient, train 12 times, bicycle 2.8 times, and walking 1.7 times,³¹ where efficiency is defined as the number of people who can use a transportation corridor the width of one highway lane in a given unit of time.

The greatest benefit the automobile has that rapid transit does not is the ability of its passenger to go anywhere at anytime. This freedom has made the automobile popular. It is a symbol of individuality. In the survey mentioned earlier, it was found that of all vehicles entering Hamilton's CBD, the average number of passengers was less than two per vehicle - including buses.³²

Weighing the advantages and disadvantages of the two, it seems that we must somehow reverse the overemphasis on individuality and provide effective and attractive rapid transit systems.

RECOMMENDATIONS

The following are some general recommendations based on the findings of this report:

1. Transportation planning must be done by a larger group. No longer can specialists be allowed to make decisions. Ecologists and Sociologists should be included along with traffic engineers. The general public should also have representation.
2. The vast sums of money currently allotted for new highway development should be rechannelled into rapid transit development.

³¹ Kenneth P. Cantor in *The Environmental Handbook* (New York: Ballantine, 1970), p. 200.

³² CHCH-TV, Traffic Feature, June 16, 1971.

3. Increased taxes on the use of the automobile and higher subsidies and low prices for rapid transit would make the latter more attractive.
4. Adequate provisions should be made for bicycle paths on all new roads.

The following are more specific recommendations:

1. An "environmental impact" study should be made of the Mountain Freeway, Redhill Expressway, and the road through Cootes Paradise.
2. A meeting between the two opposing groups on the issue of airport expansion should be held, preferably in public.
3. City council should move quickly to implement at least some of the plans in the Rapid Transit draft plan.
4. Development of an overall plan for an intermodel transportation system on a regional basis. The most recent plan is the Hamilton Area Transportation plan, done in 1963. This report is now out of date and is not used to any great extent by the City Traffic Department.³³

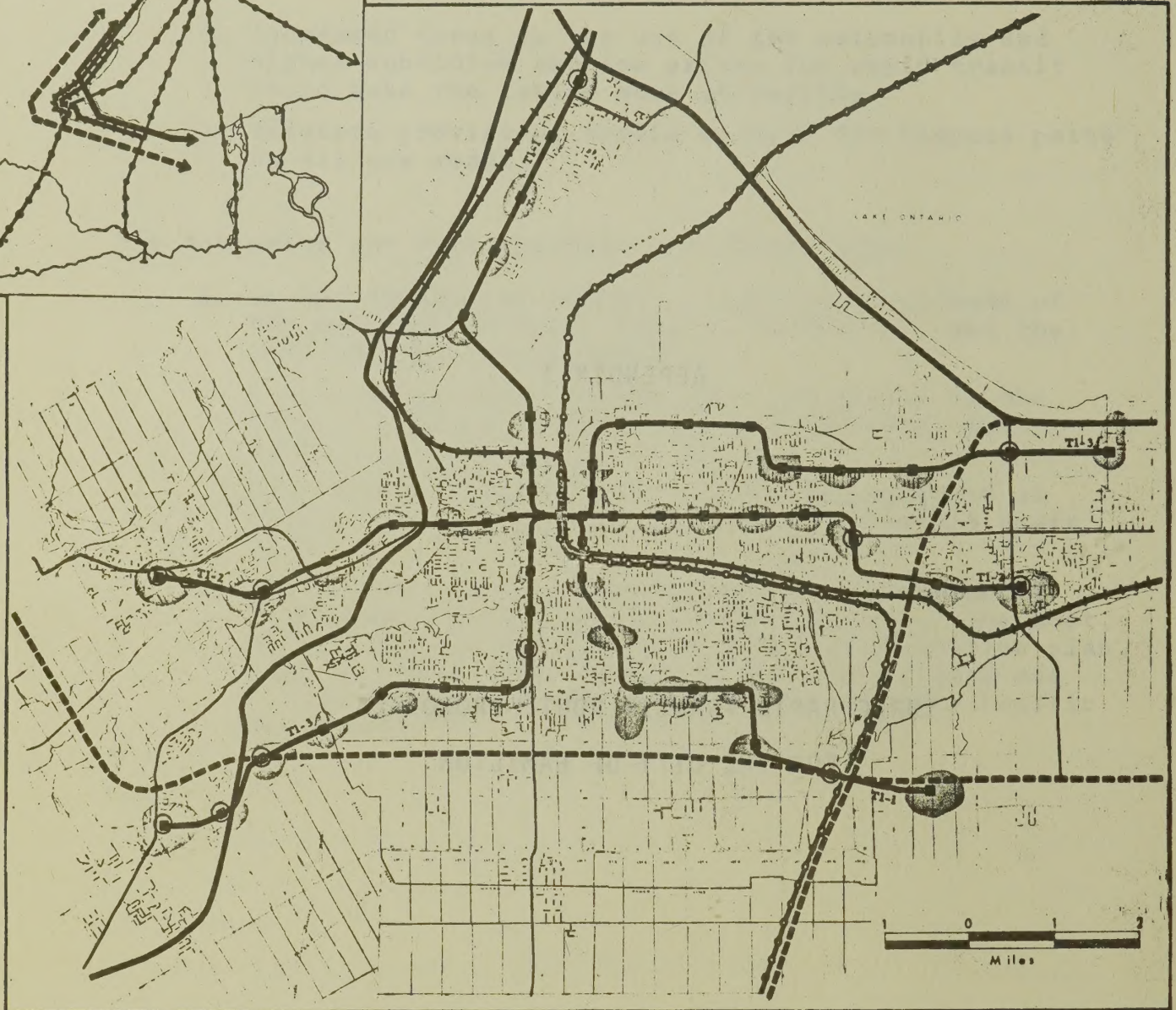
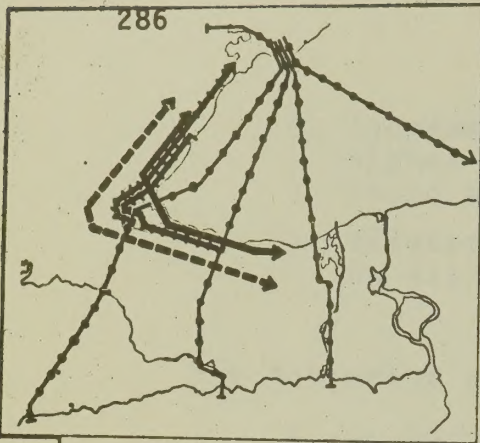
³³ Heintzel Interview.

APPENDIX I

THREE RAPID TRANSIT ROUTE PROPOSALS
FOR THE CITY OF HAMILTON

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THE PURPOSE OF THIS DOCUMENT IS TO SOLICIT OPINIONS AND TO INVOLVE AS MANY CITIZENS AS POSSIBLE IN THE PLANNING PROCESS.



METROPOLITAN HAMILTON

TRAVEL MODE

- RAPID TRANSIT.....
- EXISTING FREEWAY.....
- PROPOSED FREEWAY.....
- EXISTING HIGHWAY.....
- PROPOSED COMMUTER RAIL.....
- PROPOSED HOVERCRAFT.....

TRANSIT INTERCHANGE WITH

- BUSES, PEDESTRIANS.....
- HIGHWAY MOTORISTS, BUSES, PEDESTRIANS.....
- RAIL COMMUTERS, HOVERCRAFT PASSENGERS, BUSES, PEDESTRIANS.....

DEVELOPMENT

- AREA OF DIRECT INFLUENCE BY RAPID TRANSIT (IN NON-MANUFACTURING AREAS).....

DRAFT OFFICIAL PLAN 1976 OF THE CITY OF HAMILTON

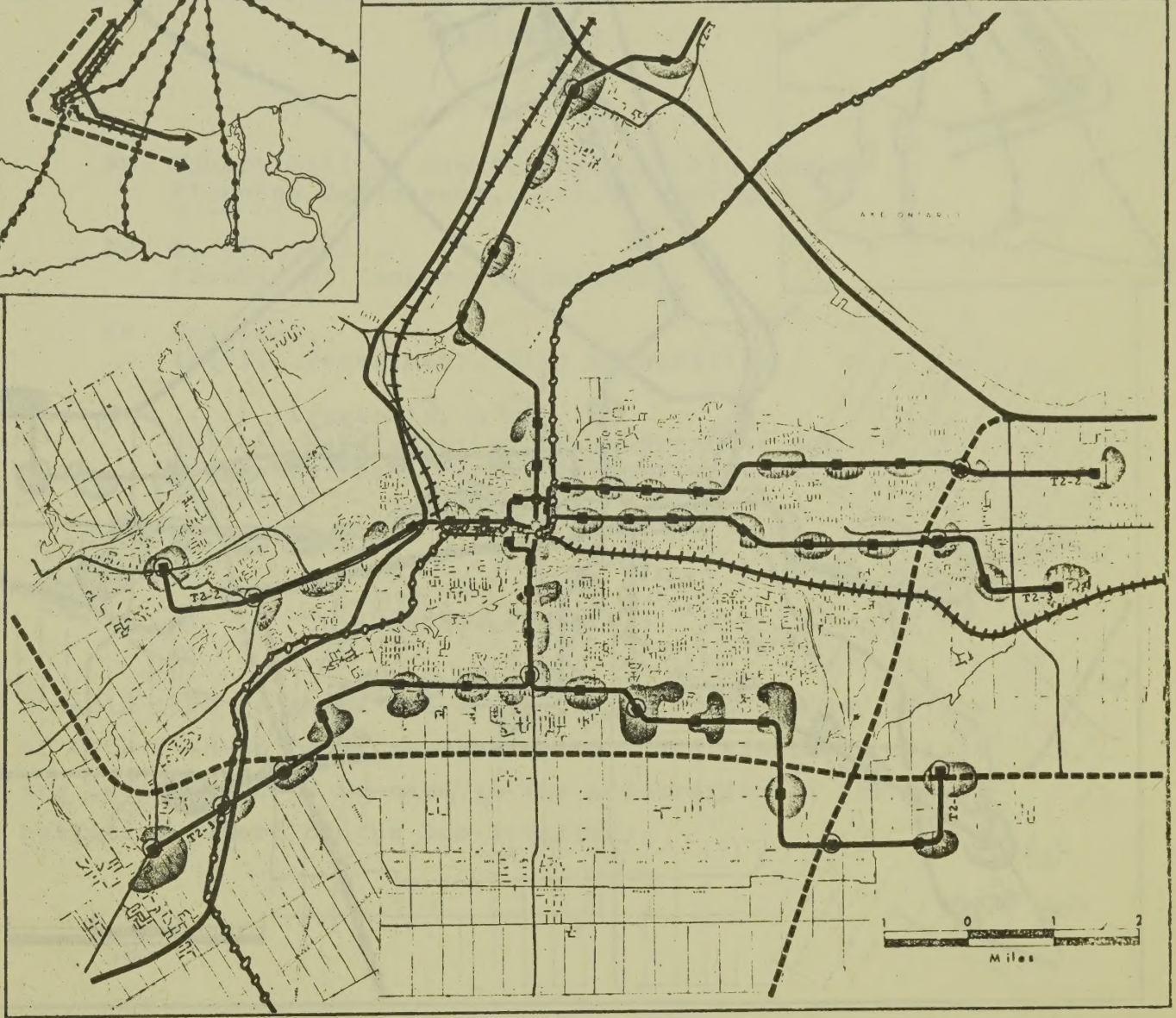
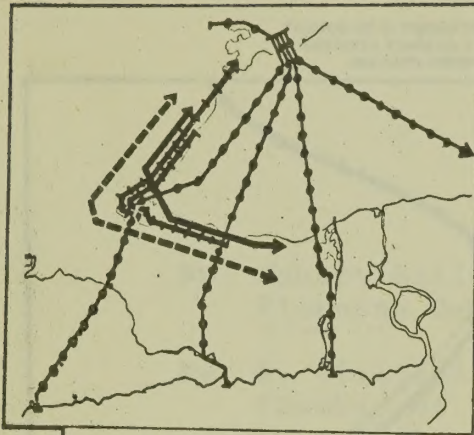
INTEGRATION AND DEVELOPMENT: PROPOSAL A

SCHEDULE

1.T1

First Edition, March, 1969, CITY OF HAMILTON PLANNING DEPARTMENT

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METROPOLITAN HAMILTON

TRAVEL MODE

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- EXISTING FREEWAY.....
- PROPOSED FREEWAY.....
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- BUSES, PEDESTRIANS.....
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DEVELOPMENT

- AREA OF DIRECT INFLUENCE BY RAPID TRANSIT (IN NON-MANUFACTURING AREAS).....

DRAFT OFFICIAL PLAN 1976 OF THE CITY OF HAMILTON

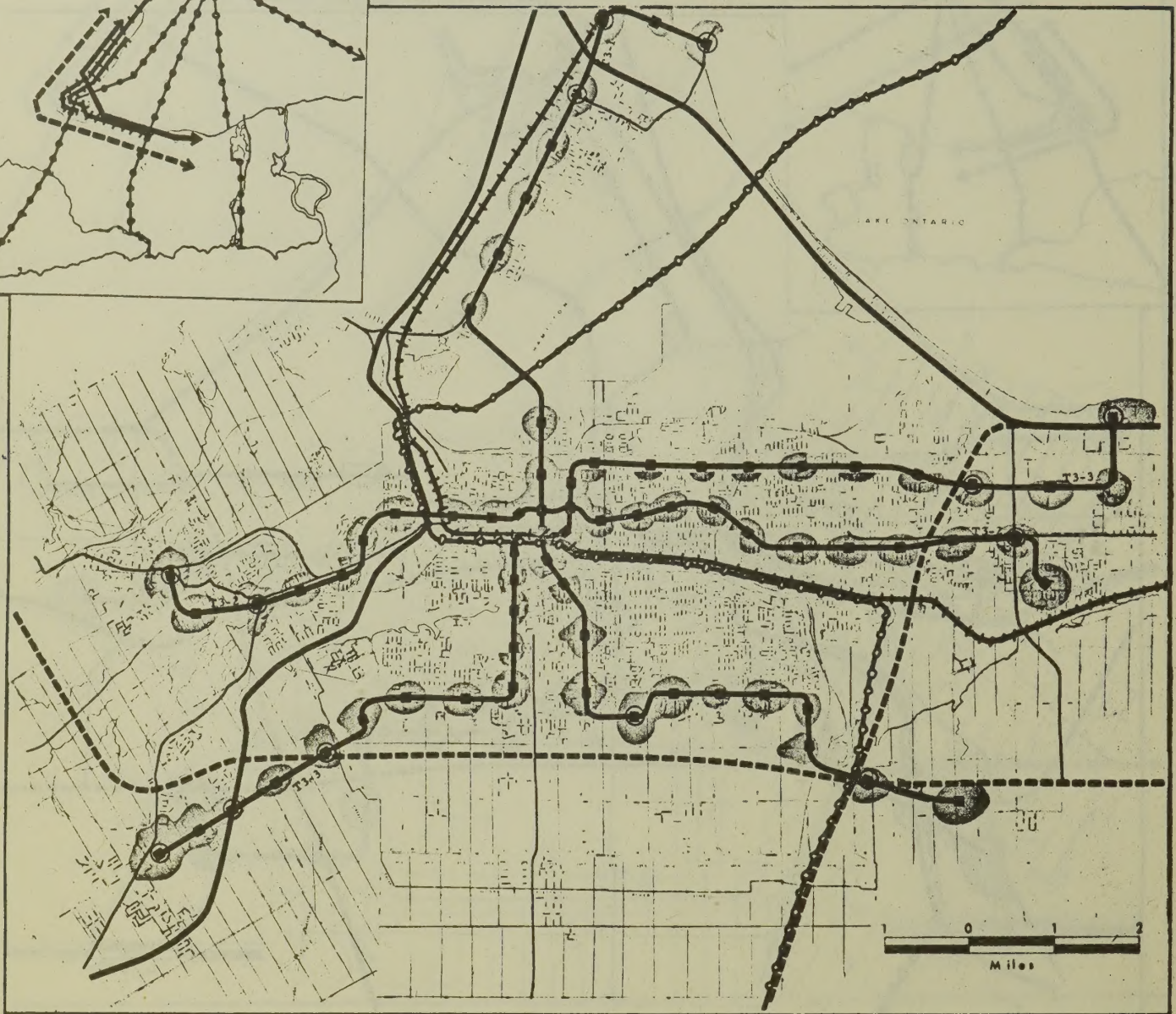
INTEGRATION AND DEVELOPMENT: PROPOSAL B

SCHEDULE

1.T2

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METROPOLITAN HAMILTON

TRAVEL MODE

- RAPID TRANSIT.....
- EXISTING FREEWAY.....
- PROPOSED FREEWAY.....
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- PROPOSED COMMUTER RAIL.....
- PROPOSED HOVERCRAFT.....

TRANSIT INTERCHANGE WITH

- BUSES, PEDESTRIANS.....
- HIGHWAY MOTORISTS, BUSES, PEDESTRIANS.....
- RAIL COMMUTERS, HOVERCRAFT PASSENGERS.....
- BUSES, PEDESTRIANS.....

DEVELOPMENT

- AREA OF DIRECT INFLUENCE BY RAPID TRANSIT (IN NON-MANUFACTURING AREAS).....

DRAFT OFFICIAL PLAN 1970 OF THE CITY OF HAMILTON

INTEGRATION AND DEVELOPMENT: PROPOSAL C

SCHEDULE

1.T3

INTERVIEWS

Mr. Robert Bailey, Commissioner of Planning,
Planning Department, City of Hamilton

Mr. B. Gillespie,
Chamber of Commerce, Hamilton

Mr. Heintzel,
Traffic Department, City of Hamilton

Mr. T. J. Fitzgerald,
Ontario Department of Transportation and
Communications (formerly Department of
Highways)

ACKNOWLEDGEMENTS

I would like to thank the above people, and Mr. Roy Wilson of CHCH-TV News Department, for their assistance in obtaining information to be used in the preparation of the Transportation Report of the Eco-Inventory.

INTERGRATION AND DEVELOPMENT: PROPOSAL C

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PART FOUR
RURAL LANDSCAPE

CHAPTER TEN

IMPORTANT WILDLIFE HABITATS AND UNIQUE NATURAL AREAS

valanne glooschenko

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...it is necessary and desirable that areas of unusual natural significance be set aside and preserved for the benefit of present and future generations before they have been destroyed: for once destroyed they cannot be wholly restored. Such areas are irreplaceable as laboratories for scientific research, as reservoirs of natural materials not all of the uses of which are now known, as habitats for plant and animal species and biotic communities whose diversity enriches the meaning and enjoyment of human life...

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INTRODUCTION

Southwest Ontario has a rich variety of life zones blending both the north and south, from boreal forest to mature Carolinian communities. It is imperative that the best examples of these habitats be kept as ecological reserves for present and future generations to study and to enjoy. The valuable--or unique--natural areas discussed in this section of the Eco-Inventory may be small northern bogs, mature forest covering many acres, or marsh along the Grand River valley with high potential for waterfowl production. These areas offer all the diversity of the natural community, and provide a gene pool of these diverse species for the future. Once destroyed, they cannot be replaced.

With population of the Golden Horseshoe region growing at a very fast rate, it is desirable to have certain areas intensely developed for recreational use. Not only will the population grow, but "the new population will have far more leisure time available, will have income exceeding anything known in the past, and finally, will have income available to be spent on leisure time in amounts not previously known. It is clear, therefore, that the demand for open spaces in Ontario will grow; *not proportionately to the population growth, but at a much higher factor, perhaps 5 to 10 times the present demand.*"² This demand for recreational space requires that certain regions be intensely developed for recreational use. Sections of the Grand River valley, parts of the Niagara Escarpment, and portions of some of the larger conservation

¹ (Title page): Chanasyk, V., *Environmental Appraisal for the Haldimand-Norfolk Study*, Dept. of Municipal Affairs, Toronto, Ont., 1970, p. 217.

² *Who Speaks for the Environment?: Policy Papers*, Committee of Chairmen of Conservation Authorities, July 1970, p. 12.

areas could be developed for a greatly increased number of users. However, equally apparent is that selected, more fragile areas must have protective restrictions applied to them which will limit or supervise intensity of use.

New concepts are being developed for use of ecological reserves. These can be seen in the plans for a new Newfoundland Provincial Park, Gros Main. At Gros Main, the major portion of the Park is undisturbed. Visitors are welcomed into an educational "visitors' centre" where they learn of the park's geological history and natural resources. Organized camping facilities are found close to the visitors' centre, but no superhighways transect the interior of the park. Around Hamilton, this concept could apply to relatively untouched regions like the Eramosa river system. Smaller areas like the Roseville Swamp and orchid bogs will require more protection, or they will inevitably be destroyed.

The Toronto-Centred Region plan has Hamilton at its southernmost point, and includes many square miles in those areas designated for urbanization or for restriction of development. This report includes the Toronto-Centred Region as far north as the Credit River Valley; south to Lake Erie, and east to include part of the Regional Municipality of Niagara. (See fold-out map in the back of the Eco-Inventory.) In this way, all of the unique natural areas within approximately one hour's drive of Hamilton are discussed.

The unique natural areas are listed according to the Conservation Authority where each is found. Indication of flood plain zoning and regulations for each Authority are included, since these regulations can be viewed as a first step in protection of wildlife habitat along river valleys. Flood

plain regulations are also important in the creation of valley corridors of open space in an otherwise rapidly urbanizing region.

Natural areas with high priority for acquisition or protection are indicated **.

CREDIT VALLEY CONSERVATION AUTHORITY

Watershed Area	--	331 square miles
Population	--	174,883
Equalized Assessment	--	\$.90

At present, the C.V.C.A. has flood plain zoning and regulations in effect on the Credit River from Lake Ontario to the Credit River Forks. However, the public has no right of access to the valley land because most of it is already in private ownership. Land acquisition programs for the Authority include Niagara Escarpment property in the Terra Cotta and the Silver Creek Reservoir area.

Brampton East¹

** West of the QEW on the Credit River are several islands which are important for archeological reasons. These were historic camping grounds for the Mississauga Indians and other tribes.

 ** Three miles north of the Halton County line along the lake-shore is one of the best remaining cattail marshes remaining on Lake Ontario, according to Dr. J. Sparling, University of Toronto ecologist. The forested area west of the marsh has been destroyed, but the marsh itself contains forest types

¹ Brampton East and other titles used in this report i.e. Brampton West, Hamilton East, Hamilton West, etc. correspond to the maps of the National Topographic Series.

that are miniatures of those found elsewhere, as well as a variety of habitat and plant communities. The rarity of this kind of lakeshore marsh community, as well as its proximity to a dense urbanized area, make this region an important one for maintenance in its present state. The developer had proposed that it be converted into a sailing basin, but local residents' groups have begun to recognize the value of Rattray Marsh, as it is called, and some of them have requested that it remain as a natural area.

Brampton West



** 84/39¹A particularly spectacular area of the Niagara Escarpment is found here below the Caledon Mountains. Scenery at this site is claimed to be some of the best in Ontario. Naturalists and others from Georgetown are hopeful that the province will act quickly to freeze Escarpment land, as urban pressure has already begun from speculation and development. Wildlife suitability here is high for deer and ruffed grouse, and the ponds north of the section have a high potential for waterfowl production. The Credit Valley Conservation Area south of it is undeveloped to date, and it is hoped that this Conservation Area will be extended towards Georgetown along Black Creek.

Georgetown itself, surrounded on nearly all sides by stream valley and patches of forest, has several groups pressuring the local council to leave these areas as open space. The stream valley is a scenic one of old pasture, woodland, and a beaver dam. Hungry Hollow, as it is called, is unusually accessible to urban users, as it lies within the Georgetown city limits. The edge of the valley is currently being discussed for high-rise development. One local resident has

¹ These numbers refer to the grid reference on maps of the National Topographic Series.

made a film of the valley entitled "Hungry Hollow", and is showing it to the local council and to interested groups.

HALTON REGION CONSERVATION AUTHORITY

Watershed area -- 363 square miles
 Population -- 165,000
 Equalized Assessment -- \$2.50/capita

The H.R.C.A. will shortly have effective flood plain regulations on the Twelve, Fourteen, Sixteen-Mile Creeks and on the Grindstone Creek. Subdivision applications for development now come through the H.R.C.A. offices, and the staff is in a position to make comments on the desirability of 5% dedication for public land along the stream valley. It is hoped that desired open space along these streams can come about through public dedication of subdivision land under the planning act. Acquisition of land along the Niagara Escarpment will exceed the acreage recommended in the Gertler report.

Brampton West

** 84/24 The Halton Region Conservation Authority property here should be extended north, and also east toward the Escarpment. At present, no roads transect the land. This area and the "Scotch Block" above it, form a continuous belt which should be maintained. Wildlife suitability continues at a high rating here for deer and ruffed grouse.

Hamilton East

03/12 An attractive mature white pine woodlot with resident owls is found in this valley corridor of the Fourteen Mile Creek. Flood plain regulations now being implemented along this stream from Lake Ontario to Palermo may protect this valley corridor against further development. The woodlot should be included in the valley corridor system.

 ** 035/045 The town of Bronte still has one mature white pine woodlot, now part of one of the oil refineries, which would make a valuable outdoor classroom. Owls, foxes, and

other wildlife are found all year. The buff-breasted sand-piper and other migrants can be observed during the migration season.

Hamilton West

Northern Burlington today features an attractive variety of farms and Escarpment land, with valleys, wooded hills, and springs. A plan to preserve prime agricultural land for agricultural use and prime recreational land for recreational use was made public in March 1972 by the Burlington planning board. Its intent was to "encourage orderly preservation of rural lands and to keep the agricultural use sound" through "rural" zoning. The plan also discusses a "natural resource" zoning, whose purpose was to "encourage orderly preservation of lands for recreational land use", some of which was eventually to be acquired by public agencies.

However, both of these zoning designations (see following page) allow for the subdivision of agricultural land into 25-acre estates. It is feared that this designation will significantly increase land value, hampering rather than aiding the ability of agencies to acquire this desirable recreational land. The plan for rural Burlington does not recognize the Escarpment as a unique recreational resource. Indeed, except for the isolated sections in "conservation land" designation and the dubious 25-acre clause, the plan gives no protection whatsoever to the Niagara Escarpment as public open space. It is suggested that any area desired for public use, particularly acreage above and below the Niagara Escarpment, be left in the old agricultural classification, controlled through land purchase options or through easements which control land use as well as provide rights-of-way. The proposed plan for the Burlington rural area appears contrary to the Gertler report, and places the Bruce Trail in jeopardy.

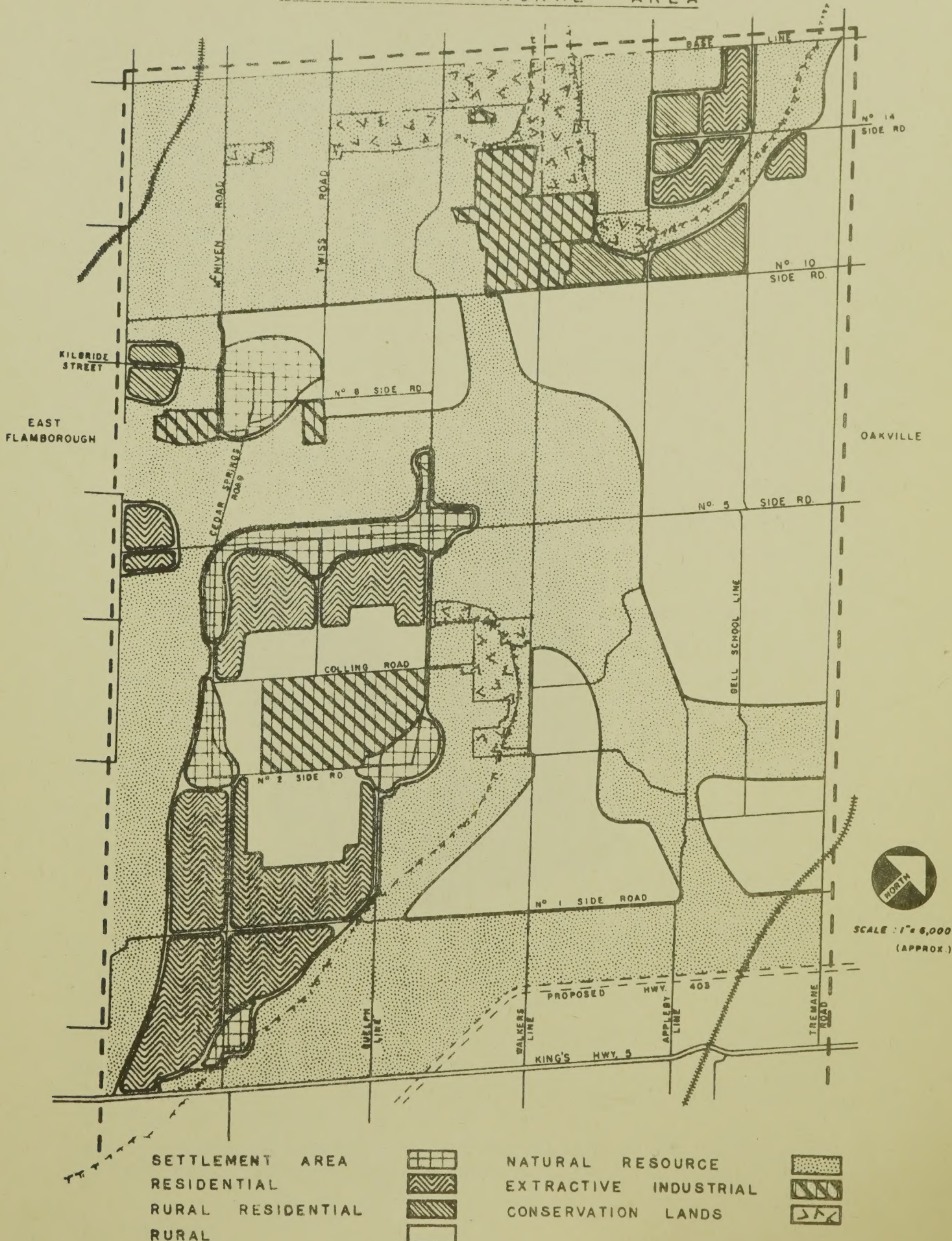
HAMILTON REGION CONSERVATION AUTHORITY

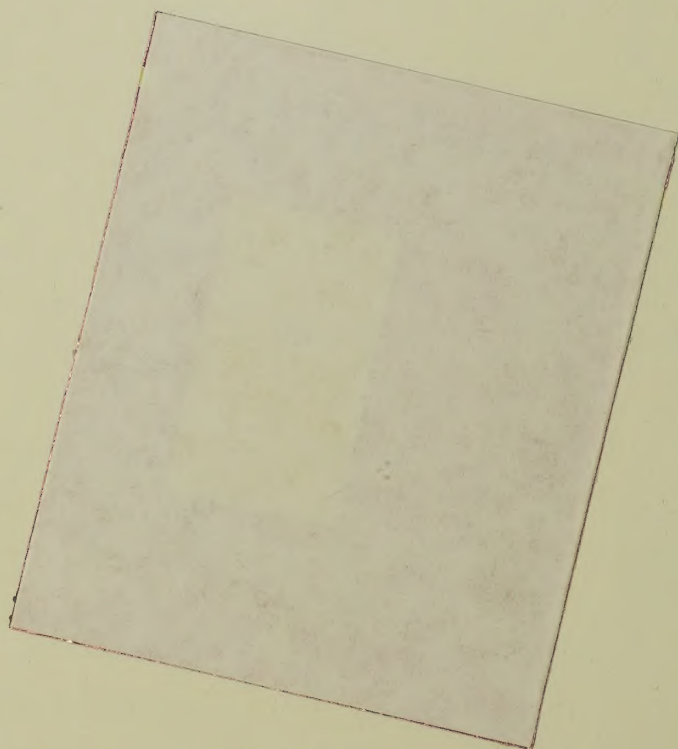
Watershed -- 185 square miles
Population - 343,122
Equalized Assessment -- \$1.80/capita

The Hamilton Region Conservation Authority's land acquisition

PROPOSED LAND USE PLAN

BURLINGTON RURAL AREA





program recommends that a total acreage of 16,000 be acquired or controlled for conservation or open space purposes. By the end of 1971, land acquisition will reach 4000 acres and easements will control 2000 acres of the total 16,000. The Authority has flood plain regulations in effect for the Red Hill Creek and other streams in the area, and plans for acquisition of strategic lands in the Dundas Valley area which will exceed those recommended in the Gertler report.

7

** 85-87/87-88 There remains *one* unique strip of Niagara Escarpment land within the Hamilton Region Conservation Authority that should be mentioned here. The area, bounded by Hwy. 403 and Mohawk Road, is described in detail in Chapter 11, "The Niagara Escarpment". Local interest has been urging the Hamilton Region Conservation Authority to acquire the section from the 403 to the radial line, but it has been noted that the area south of the radial line to Mohawk Road is valuable for its birdlife and provides a buffer for the Bruce Trail.³ In addition, it would offer additional, much-needed recreational land for Ancaster and a newly planned nearby subdivision, the Bruce Trail Village. This entire area should receive high priority for immediate acquisition.

Hamilton West

Cootes Paradise Marsh in the City of Hamilton is owned and kept as a nature preserve by the Royal Botanical Gardens. It is second only to Long Point for numbers of migratory species in spring and fall; whistling swans, herons, egrets and many species of waterfowl use the marsh at these times. The area also has a high wildlife suitability rating for resident waterfowl production. The Federation of Ontario Naturalists' literature refers to it as "undoubtedly the single most interesting area in the region"⁴ because of its variety of flora and fauna.

³ Communication; Dr. James Pringle, Royal Botanical Gardens, Burlington, Ontario.

⁴ Bryant, George, "Hamilton", *A Naturalist's Guide to Ontario*, Federation of Ontario Naturalists, Unpublished Edition.

Its large size -- and its location in a highly urbanized area -- make it a unique attraction.

865/925 The Hopkin's Property, recently acquired by the Hamilton Region Conservation Authority, deserves mention because it has been one of the migratory stops of the saw-whet owl. Whistling swans can also be seen here in mid-April and fall.

The swampy area below the Hopkin's property also has many ducks and shorebirds which make migratory stop-overs. Butterflies of unusual occurrence which have been found here are the Two-spotted and the Dion Skipper. (*Atrytone bimacula* and *A. dion*).



** 002/895 A productive marsh area supporting a wide variety of waterfowl and aquatic life lies on both sides of the CNR tracks between the Van Wagner Beach Road and the QEW, northwest from the Stoney Creek traffic circle. The marsh area is narrow but long, extending .3 miles on both sides of the CNR tracks, and additional wetland extends south of the QEW. This area is a small replica of Cootes Paradise Marsh to the west, and is the *last site for aquatic wildlife which remains along the eastern city limits*.

White water lilies, green herons, least bitterns, grebes, long-billed marsh wrens, as well as coots and gallinules have been sighted here. Some of the migratory birds using the area are the horned grebes, great blue herons, egrets, and black terns. Part of the land is privately owned, and there are signs of land fill in the area. The remainder is owned by Ontario Hydro. The Department of Highways has indicated it would like to buy

up additional land for widening the QEW and for service roads in this region. It would be a real tragedy if this were allowed to happen to the last outpost for waterfowl on the east side of the city.

Galt East



** 70-74/00-06 Beverly Swamp consists of several miles of poorly drained woodlands which contain several species of orchids, boreal spruce and tamarack, a wide variety of butterflies and ferns, and much birdlife. It has a high suitability rating for deer, ruffed grouse, hare, and geese, and represents the southern limit in Ontario for five species of mammals: the showshoe hare, woodland jumping mouse, porcupine, water shrew, and northern flying squirrel. The northern waterthrush has been observed here. About 30% of this valuable watershed has been acquired by the Hamilton Region Conservation Authority, and it is expected that the remaining acreage will be purchased as the land -- and funds -- become available. The northern section of the swamp would provide an ideal location for a nature study centre, and the school board has been approached with this suggestion.

NIAGARA PENINSULA CONSERVATION AUTHORITY

Watershed area	--	936 square miles
Population	--	350,000
Equalized Assessment	--	\$0.60/capita

According to the Gertler report, 2000 acres of Niagara Escarpment land in this watershed are recommended for acquisition. At present, the authority has no plans for a land acquisition program. * There are no plans for flood plain zoning or regulations at this time.

* Ed. note: In July 1972, an initial purchase of 61 acres of Niagara Escarpment land was made by the N.P.C.A.

Grimsby East

10

** Two mature woodlots are found beneath the Niagara Escarpment within the city limits of Grimsby, and are largely intact at present. Site #1 includes mature white ash, red ash, red, white, and swamp oak, bitternut hickory, black cherry, basswood, spicebush, and shagbark hickory. Site #2 features these in addition to beech and *Ilex verticillata*, the only place where this species has been discovered beneath the escarpment. It is hoped that the school board will be interested in acquiring site #2, as it would make an irreplaceable outdoor classroom. See appendix for a detailed map of these sites.

Beamer's Falls, now managed by the N.P.C.A., is noted for the dense numbers of migrating hawks which pass this site during the spring. 500-1000 per day are often observed when migration reaches its peak during April. All species of raptors are found, with broadwinged hawks reaching abundance in late April. In migration, the hawks apparently reach Lake Erie, follow the Niagara River, then go along Lake Ontario to Hamilton before turning north. They often follow the Escarpment line, and can easily be seen from the Beamer's Falls site. Turkey vultures have also been observed in numbers. Many rare northern plant species which are common here include white cedar, paper birch, ground yew, and mountain maple. Purple cliff-brace, *Pellea atropurpurea*, grows here in one of the few sites where it is found south of the Bruce Peninsula. The Carolina wren and Louisiana waterthrush have been recorded as nesting here.

11

** 06-09/835-845 An especially scenic area of the Niagara Escarpment is found here.

12

** 19/79 This swamp woodlot has been noted for its migrating and nesting passerines (song birds), reptiles, amphibians, swamp oak, and sedge marsh. The wood duck and short billed marsh wren nest here. The swamp feeds Thirty Mile Creek and should be preserved as wetland.

13

** 06-7/63-65 This area, called Warner's Woods, is a remnant forest with one portion owned by the Niagara Peninsula Conservation Authority and the remainder in private hands. At present, no roads break up the land. It has shallow swamp areas on clay, standing pools which dry up during the summer, and a variety of wildlife including the blue-tailed skink, the only site around Hamilton where this reptile is found. Turkey vultures nest here.

11/78 A mature uncut mixed forest, this area is noted for its large tupelo, swamp oak, and winterberry holly. The tall highbush blueberry is found in the wet, acid soil of this area. At present, the owners of this plot have no plans to market the timber.

Grimsby West

90-99/795-77 20-Mile Creek 90-600/75/67 Welland River
The Dept. of Treasury and Economics publication *Design for Development* recommends that the river valley corridors of the Welland River and of the Twenty-Mile Creek be utilized as corridor systems for recreational open space.⁵ At present these valleys are heavily farmed up to the watercourse itself and contribute considerable amounts of pesticide, fertilizer, and siltation into the streams. Small wetland areas in the headwaters of both these streams are highly rated for waterfowl production. See wildlife suitability ratings map on p. 325 and the following section on river valley corridors.

85/65 Heronry.

⁵ *Design for Development: Niagara (South Ontario) Region; Phase 1: Analysis*; Regional Dev. Branch, Dept. of Treasury and Economics, June 1970, p. 194.

Niagara West

14

** 26-28/779-790 This area of the Niagara Escarpment is described as the least disturbed Escarpment section containing the best examples of typical plant communities in the Niagara Peninsula. See appendix for complete description and species list.

14

** 35-36/750-755 A particularly scenic area of the Niagara Escarpment is noted at this location.

15

** 34 and 37/76 Natural red cedar stands are found here; they surround Niagara Escarpment land, and are rare in this part of Southwest Ontario.

37/65 Ridgeville Forest; a swamp forest with tulip trees and several shrubs rare in the Niagara Peninsula.

Welland West

16

** 41/538 This area is the last undrained section of the Wainfleet Bog. It is one of the few refuges of the Mississauga rattler and of the rare spotted turtle. The bog provides nesting sites for warblers, teal, mallards, and other species of waterfowl. Plant species include 4 blueberries, the northern bog willow, heaths, cranberries, 2 species of chokecherry, and marsh plants like the sundew and pitcher plant. The bog is being drained and mined for peat, and only the small section in the east of Humberstone county remains largely intact. It would be a tragedy for the entire bog to be destroyed; the small area remaining is less than one-tenth of the original. See complete description and species list in the appendix.

40/48 Sand dunes at this location along Lake Erie and Port Colborne marsh are the only ones along Lake Erie for some distance. Marsh herons, other birds and wildlife are found here.

42/55 Mud Lake is noted for waterfowl, orchids, and for spring migrants.

315/585 Marshville Station Clay Plain; exceptionally large specimens of maple, white oak, and red oak are noted here. A heronry is located in the east sector. See appendix.

GRAND RIVER CONSERVATION AUTHORITY

Watershed -- 2,627 square miles
 Population -- 440,294
 Equalized Assessment -- \$1.59/capita

Much of the Grand River Conservation Authority lies within the large Toronto-Centred Region which consists of two subregions. Authority program and policies in the subregion centred on Toronto (See map I, Zone I in the back of the Eco-Inventory) relate to urban conflicts with and requirements for natural resources. Land in Zone 2 requires land use policies to retain open space, agriculture, and recreation. The remainder of the watershed lies in the southern Niagara Development region where the demands on the Grand River watershed have not yet been clarified.

One of the greatest thrusts of the present Grand River Conservation Authority's program is retention of river valley corridors for public use. "In the days ahead, one of the greatest assets to this region will be the corridors

of open space, preserved along the navigation routes of the Grand River System."⁶

Guelph East

67/18 Hamlin Creek feeds Kortright Park and the Niska Waterfowl Refuge; trout are found in the stream, and deer and fox in the watershed. The watershed provides a valuable source of water for the Speed River, producing approximately 1,000,000 gallons per day. Guelph has suspended plans for development of the area, and the Grand River Conservation Authority has expressed interest in contributing to the cost of acquisition. The Guelph Field Naturalists' Club has been instrumental in influencing both City Council and the Conservation Authority favorably toward preservation of this watershed.

17

** The section of the Eramosa River above Rockwood, and the Eramosa tributary Blue Springs, are very highly rated for recreational potential and for wildlife suitability. The streams are unpolluted, and offer excellent trout fishing. Members of the Bruce Trail Club are building an extension into the area, and students at University of Waterloo's School of Urban and Regional Planning have developed a foot-path linking these and other smaller streams.⁷ The land lies within the "commuter shed" of the Toronto Centred Region plan, which would make it even more valuable preserved in its natural condition.

Plans for the commuter shed indicate that it should not be heavily urbanized, but should remain in large estates, agriculture, or conservation land. (See Map I, Zone 2 in the back of the Eco-Inventory.) In this way, the dense urban

⁶ Coutts, G.M. General Mgr., Grand River Conservation Authority, 1970 Annual Report.

⁷ Communication; Dr. R. Dorney, School of Urban and Regional Planning, University of Waterloo, August 1971.

band around the lake from Toronto will be broken before the urban sections of the Kitchener-Waterloo and Brantford area begins. Both of the valleys have stands of white cedar, some of it on bog land as at Ospringe, and some on flood plain as below Brisbane. There is a rich variety of plant life in the area.

Rockwood Conservation Area is extremely picturesque, with a white cedar community and two uncommon and one rare fern that occur here in limestone boulders and on vertical cliff faces. (Bulblet bladder fern, rock polypody, and green spleenwort; see appendix for complete species list.) This conservation area is beginning to be heavily used. The Eramosa-Blue Springs river system discussed above will experience the same pressure of overuse if the area is developed with roads and extensive public facilities.

Guelph West

- 18 ** 47/41 A heronry for great blue herons is located here off Highway 6.

Galt East

- 19 ** 75/15 Moffat Marsh: an International Biological Program⁸ surveyor (see below) has described this as a "remnant of the original state of the area, and one of the best developed boreal woods" in this region of Southwest Ontario. The Department of Lands and Forests manages a plantation to the west, and a hardwood woodlot to the north. The entire area is an excellent example of different stages of succession from bog to scrub-wetland to swamp. Part of Moffat Marsh is privately owned, and the rest is a section of the Wellington

⁸ Macdonald, Ian; Ontario Surveyor for *International Biological Program*. (I.B.P. is international in scope, involving 40 countries. Its programs include Conservation of Terrestrial Communities, Human Adaptability, Production in Freshwater, Marine, and Terrestrial Communities, and Use and Management of Biological Resources.)

County Forest. An arrangement should be worked out with the several owners so that this section of the marsh is not drained or otherwise disturbed. See appendix for complete species list.

20

** 62/66-66/12 The upper section of Galt Creek is highly rated for trout, and as a natural area. The region is described as northern coniferous swamp forest, with cedar, bog plants, etc. Wildlife suitability is high.

21

** 71/96 This magnificent lowland forest with southern deciduous trees has been highly rated by Dr. P. Maycock of the University of Toronto. The area provides a complex of the lowland forest species of Southern Ontario, and deserves speedy protection.

69/085 Crieff Bog; this area is partly owned by a quarry company and is well known to photographers and naturalists for its wildflowers.

69/15 This cedar swamp shelters breeding hawks, and has a high wildlife suitability rating for deer, ruffed grouse, and European hare.

78/89 This area is typical of the mixed hardwood forests of southern Ontario and was highly rated by International Biological Program biologist Ian Macdonald.

67/91 A mixed hardwood forest as above.

76/97 A heronry.

Galt West

22

** 46/00-03 Roseville Swamp; this large continuous wetland feeds Cedar Creek and maintains a rich variety of plant and animal communities. The local naturalists' club own a small section to the south, but the remainder is privately owned at present. Both the Grand River Conservation Authority and the naturalists' club are interested in seeing this splendid complex preserved. The area supports much wildlife variety, especially for the large, more wary species such as coyote, mink, and bobcat. Cedar Creek itself has a high wildlife suitability rating for waterfowl. The town of Ayr on Cedar Creek has expressed interest in maintaining the entire watershed in its present state. For a total description and species list, see appendix.

51/01 An upland forest on calcareous soil; Canada geese use the upper northeast corner.

449/965 Lester's Lake; this area is an excellent if somewhat small example of the cedar bog forest formations and their transition to upland cedar swamp forest. For a complete description and species list, see appendix.

23

** 53/94 Paris Cranberry Bog; one of the best examples of leatherleaf bog in this area. It is the largest open bog in the locality, and is well known to naturalists in other parts of Ontario and elsewhere. Marsh hawks, bitterns, and bog-associated plants are found here. The Grand River Conservation Authority has expressed interest in the area. If purchased, a careful restriction of use to the most passive activities would be required to keep the bog in its natural state. For a complete description and species list, see appendix.

23

** 50/94 On the causeway intersection north of Paris Cranberry Bog two rare butterflies have been recorded -- the Mulberry Wing (*Poanes massasoit*), otherwise found in Rondeau Provincial Park on Lake Erie, and the Bog Copper (*Lycaena epixanthe*). This last species is only rarely found south of the Arctic. The causeway itself has a climax forest of sugar maple and beech; the cerulean warbler, yellow-throated vireo, and pileated woodpecker are recorded.

24

** 50/90 An excellent oak-hickory forest with high priority for inclusion into the Pinehurst Conservation Area. It should be for passive recreational use only, with no trails, roads, etc., as the area is too fragile to withstand wholesale "development" as a standard recreational area. A breeding population of the more rare turtles and amphibians.

24

** 50/89 Prairie relict site with representative species of original prairie, big bluestem, little bluestem, Indian grass, etc.

47/91 Dickson Forest; because of the diversity of habitat, this has been proposed as a wilderness area. The upland forest of white and red oak undergoes a gradual transition to wetland in the Turnbull Lake area. For a complete description, see appendix.

25

** 58/973 Oliver Bog; I.B.P. biologist Ian Macdonald has described this bog as the "best example of a complete classical bog succession in the country". The area shows the complete successional stage from open water to floating bog edge, and finally mature black spruce forest. The region would be ideal for introductory ecology study by secondary schools, and is at present almost completely undisturbed. The bog is privately owned, and without protection, its future

is doubtful. For a complete description, see appendix.

49/14 A heronry.

52/12 Oil Well Bog; an excellent example of bog habitat in a transition phase. Vegetation-soil relationships have been studied here by Dr. W. M. Dale of the University of Guelph. Bird species are typical of a swamp forest, and may include nesting populations of the yellow-billed cuckoo. See appendix for complete description and species list.

Oil Well Bog is used by Waterloo Lutheran University as well as by the University of Guelph. The University of Waterloo uses Dickson Forest and the Paris Cranberry Bog extensively.

Brantford East



** 79-80/85-87 A maple-beech forest with many breeding populations of birds. The golden and blue-winged warblers nest here.

71/65 These pothole swamps in the Indian Reserve result from glacial activity. The area has high wildlife suitability and provides good wood duck terrain.

72/69 A rich mixed hardwood forest of maple, ash, etc., is located here.

Brantford West

53/87 A highly-rated forest of maple, ash, etc., as recommended by Dr. P. Maycock of the University of Toronto, surrounds the Blue Lakes at this location. The area is in private hands and is under contract to the Department of Lands and Forests. The region is used by great blue herons and other waterbirds.

Turkey vultures nest here and osprey have been observed.

51/70 A highway now cuts through this large wetland, but enough remains to be considered a valuable wilderness area.

Grimsby West

Islands in the Grand River below York have wildlife value.

The entire Grand River valley is a well-defined corridor which lends itself to the development of an open-space system linked with the Lake Erie shoreline. As such, it would have immense recreational value to the entire Golden Horseshoe area as well as to Hamilton. This concept is recognized by the Grand River Conservation Authority and stressed in the *Haldimand-Norfolk Environmental Appraisal*.

Simcoe East

692/407 Prairie relict as recorded by Dr. P. Maycock, University of Toronto. (Site #34).

719/578 Springvale Cedar Swamp contains a 3-acre cedar scrub community and a 1-acre cedar forest which are both fairly unique in Haldimand county. This is the only recorded area for the yellow lady's slipper (*Cypripedium Calceolus*) in the county. For a complete description and species list, see appendix.

Dunnville East and West

27 ** Marshy areas along the lower Grand River are particularly important for breeding and migratory waterfowl, especially the large marsh area below Dunnville. Mohawk Island offshore is important for nesting gulls and all the points, particu-

larly Grant Point, are excellent places to view migrating waterfowl and shorebirds.

LONG POINT REGION CONSERVATION AUTHORITY

Watershed -- 751 square miles
 Population -- 79,000
 Equalized Assessment -- \$1.00/capita

The Long Point Region Conservation Authority was recently formed by the joining of Otter and Big Creek Conservation Authorities. The outstanding natural attractions in the Long Point watershed are Long Point itself, largely privately owned, and the Big Otter and Big Creek rivers. The Long Point Region Conservation Authority recognizes the value of these areas, and is in agreement with *Haldimand-Norfolk Environmental Appraisal* recommendations that the Big Otter and Big Creek valleys be preserved in a river valley corridor system.⁹

Long Point East and West

Long Point has a unique Carolinian-Alleghenian life zone, and an exceptionally large number of reptiles and amphibians. Long Point marshes produce an abundance of waterfowl, and its landscape features -- sand beaches, sand dunes, and deciduous forests -- are quite distinctive. Almost all of the Point is owned by the Long Point Company, a small group of conservation-minded individuals. The *Haldimand-Norfolk Environmental Appraisal* suggests that this area have:

..."no other alternative use than that of preservation as an entirely natural area for public use under the most rigid conditions of control. This would exclude all forms of active recreation and all forms of passive recreation except those related to nature

⁹ Communication; J.G. Smith; Chairman, L.P.R.C.A., August 1971.

appreciation and interpretation and for purposes of systematic scientific study. This area would appear to meet the criteria for a National Landmark currently under consideration by the National and Historic Parks Branch of the Dept. of Indian Affairs and Northern Development. This category applies to areas which are small, scenic, and not warranting development. (p. 515)

Long Point West

28

** 45/28 The area around St. Williams Forest Station has colonies of prairie warblers; lark sparrows breed here at present, the first in Ontario for 20 years. The Karner Blue butterfly (*Lycaedis melissa samuelis*) is recorded here, the only place where it has been noted in Ontario. The region is one of four sites in Ontario for the Dwarf Oak (*Quercus prinoides*.)

Port Burwell East and West

29

** Big Otter and Big Creek River valley are forested and generally untouched and have high wildlife suitability and recreational potential. Their proximity to the regions along Lake Erie that are slated for rapid industrial and urban expansion make them particularly valuable preserved in their natural state. Discussion of these rivers and of the Grand River follows in the next section.

REGIONAL RIVER VALLEYS AND OPEN SPACE

Twenty Mile Creek and the Welland River

In light of the dense urbanization expected throughout the Golden Horseshoe region and particularly the Hamilton metropolitan area, it is important to provide for recreational needs and land acquisition in the immediate future. Recommendations from the provincial *Design for Development* for

the area south of Hamilton name the *Twenty Mile Creek* and the *Welland River* as having recreational potential, and indicate that they could be used as valley corridors to help satisfy the need for regional open space.¹⁰ In addition, the Canada Land Inventory wildlife suitability ratings show these river valleys to have good potential for wildlife production, particularly for waterfowl.

There are no flood plain regulations in effect for the Niagara Peninsula watershed and, at present, no plans for flood plain mapping. Farming is intensive along many sections of the Welland River and Twenty Mile Creek and often plowing, fertilizing, and pesticide spraying is carried on up to the edges of the stream. This has caused erosion of top soil into the rivers as well as addition of unknown amounts of nutrients and pesticides. Recommendations from the *Environmental Appraisal of the Haldimand-Norfolk Study* already cited urge that farmers cultivate no closer than 50 feet from an open body of water and that legislation be introduced to implement this. Specifically regarding the valleys of rivers and streams, the Study recommends that a "zone of 1,000 feet in width be kept between the edges of a river valley and the nearest real estate development in order to insure permanency of the natural condition of river valleys".¹¹

A program of land management that prevented cultivation--or development--within this narrow area along streams would provide river valley corridors of immense recreational potential for walking trails and wildlife habitat. In addition, keeping the stream banks and adjacent land under permanent cover would reduce erosion and stream pollution. Flood plain mapping and regulations are a logical first step in recreational use of river valleys.

¹⁰ *Op. cit.*, (Design for Development), p. 194.

¹¹ *Op. cit.*, (Environmental Appraisal), Recommendation #63.

Such a program could begin with the Welland River which will shortly have a large dam (the Binbrook Reservoir) completed on the upper sections of the watershed.

Grand River Valley

The Grand River valley corridor is highly recommended as potentially one of the most valuable recreation systems in this part of Ontario. It has been described as a "well defined corridor which lends itself readily to the development of an open space system linked with the Lake Erie shoreline system. It is rich in historical and water features, the culture of the Six Nations Indians, and natural vegetation. The valley corridor could become one of the most valuable recreation systems in this part of Ontario, servicing...populations of Brantford, Hamilton, the Golden Horseshoe and the Niagara Region, as well as tourists."¹² Programs of the Grand River Conservation Authority to acquire and protect valley land are commendable, and deserve much greater financial support.

Big Otter and Big Creek

The Big Otter and Big Creek Valleys and their related uplands have as yet little development. They are generally v-shaped valleys, steep-sided, heavily wooded, and virtually unspoiled wilderness. The natural features consisting of trees, water, wildlife and landform are:

"the best in the inland part of the Study area...The Big Otter-Big Creek landscape has great potential for quality recreational development, but ecologically it is among the most delicate of the landscapes in the area...As with the Grand River valley, these valleys will assume immense importance as an inland 'breathing space' as the population of this and other parts of Ontario increases...Potential lies in the fact that these natural corridors could be linked to the other landscapes as part of a larger regional system...

¹² *Op. cit.*, (Environmental Appraisal) p. 504.

This corridor system would include the Grand River valley, and the Lake Erie shoreline, Long Point and the Big Otter and Big Creek landscape." 13

WILDLIFE HABITAT AND THE URBAN DWELLER

There is a growing belief that contact with nature may be an essential ingredient in protecting the emotional health of the urban dweller. "Urban wildlife" has now become a fashionable topic, with a recent Science Council study going so far as to recommend that 10% of Canada's scientific dollars spent on wildlife be directed toward urban areas by 1990.¹⁴

All recent studies on wildlife management prove that non-consumptive uses of wildlife, i.e. viewing, photography, etc., equal and in most cases surpass the consumptive use of wildlife management for hunting alone. A recent study of the Grand River Conservation Authority estimated that intensive management of Luther Marsh will provide 10,000 man-days of hunting recreation and approximately 20,000 man-days of non-consumptive recreation. Establishment of a breeding population of giant Canada geese is expected to provide 50,000 man-days of viewing recreation as opposed to 10,000 man-days of hunting.¹⁵

South Ontario has an ample amount of land with high suitability for wildlife production. (See wildlife suitability map in appendix.) These areas of high suitability should be protected, and wildlife management here begun in the near future. There has been very little wildlife management work of benefit to the non-consumptive user, and this aspect of

¹³ *Op. cit.*, (Environmental Appraisal) P.512.

¹⁴ Calamai, Peter; "Wildlife Solution for Urban Desert?"; *Hamilton Spectator*; Aug. 25, 1971.

¹⁵ Humphrey, Gartley, et al; *Grand River Basin*; unpublished report; Grand River Conservation Authority, p. 20.

the program should be emphasized much more than in the past. (Work of this kind has been recently initiated by the Lake Huron District of the Dept. of Lands and Forests.)

Small communities in their natural state--with the full complement of predator and prey species--should be carefully protected as part of the heritage of the next generation. Habitat for fox, bobcat, deer, coyote, raccoon, hawks, and waterfowl could be provided along protected river valleys and elsewhere. Should we choose not to preserve wildlife habitat, the existence of these wild creatures in the creeks, bogs, and forests within an hour's drive of the Hamilton area will soon be only a memory of another era.

SUMMARY

Wetlands

Areas such as Roseville and Beverly Swamps serve as natural "sponges" or catchment basins, helping to maintain a constant even water supply to the streams which flow from them. These swamps and the Wainfleet and Paris Cranberry Bog and other marshy wetlands have a unique flora, and support breeding populations of birds and amphibians not found elsewhere in Southern Ontario.

Forested Land: Areas of High Wildlife and Waterfowl Production

Within the Hamilton city limits, Cootes Paradise Marsh and the wetlands opposite Van Wagner's Beach offer opportunity to observe wildlife and aquatic communities close at hand. In addition, there are excellent examples of forest ecosystems and areas of high wildlife suitability within close proximity of the Hamilton metropolitan area. With the exception of

Cootes Paradise, these areas are all in private hands and subject to sale and development.

Scenic Areas

The Niagara Escarpment is the primary scenic resource and is discussed in another section of the *Eco-Inventory*. Particularly scenic regions mentioned in this section include those below the Caledon Mountain area, around the "Scotch Block", and in the Niagara Peninsula watershed.

River Valley Corridors and Open Space

Flood plain zoning and regulations are an important first step in open space systems along river valleys in this region. With restriction of development along river valleys (as urged by the *Environmental Appraisal of the Haldimand-Norfolk Study*) the upper portions of Galt Creek, and the Eramosa River and Blue Springs Creek could be maintained as high quality cold water fishing streams. Otter Creek and Big Creek which flow into Lake Erie are highly rated for recreational use and wildlife habitat, and these valley corridors should be preserved.

Following flood plain zoning, the Grand River Conservation Authority is acting to acquire portions of the Grand River for open space purposes. This type of protection should be initiated within the Niagara Peninsula watershed for the Welland River and the Twenty Mile Creek, both of which have good potential for waterfowl. At present, both the Welland River and Twenty Mile Creek flood plains are heavily farmed up to the stream, causing erosion and pesticide contamination of the waterways.

RECOMMENDATIONS

1. The concept of *passive use* of selected ecological reserves should be introduced by the Conservation Authorities and/or by the Department of Lands and Forests. This means that these areas would have restricted use by the public, in that no major camp-grounds, large picnic facilities, or other services would be provided. The value of the ecological reserve would require its maintainance in as natural a state as possible without these developments. An example is the Eramosa River valley system (discussed on p.310) which should not be encouraged to heavy use. This will inevitably occur if major road systems are built here.
2. Studies should be made to determine what types of research and institutional use are compatible--and which are not compatible--with the long range preservation of specific ecological reserves.
3. One of more dry northern areas of Beverly Swamp would make an ideal setting for a nature study centre open to use by the schools of the area.
4. *Non-consumptive use of wildlife resources* i.e. viewing, photography, etc., equal and in most cases surpass the consumptive use of hunting alone. Wildlife management programs have had very little work of benefit to the non-consumptive user, and this aspect of management programs should be emphasized much more in the future.
5. Flood plain zoning and regulations should be initiated in the Niagara Peninsula watershed.
6. A land acquisition program for strategic Niagara Escarpment areas, the remainder of the Wainfleet bog, and other sites should be initiated in the Niagara Peninsula watershed.

APPENDIX I

WILDLIFE SUITABILITY RATINGS

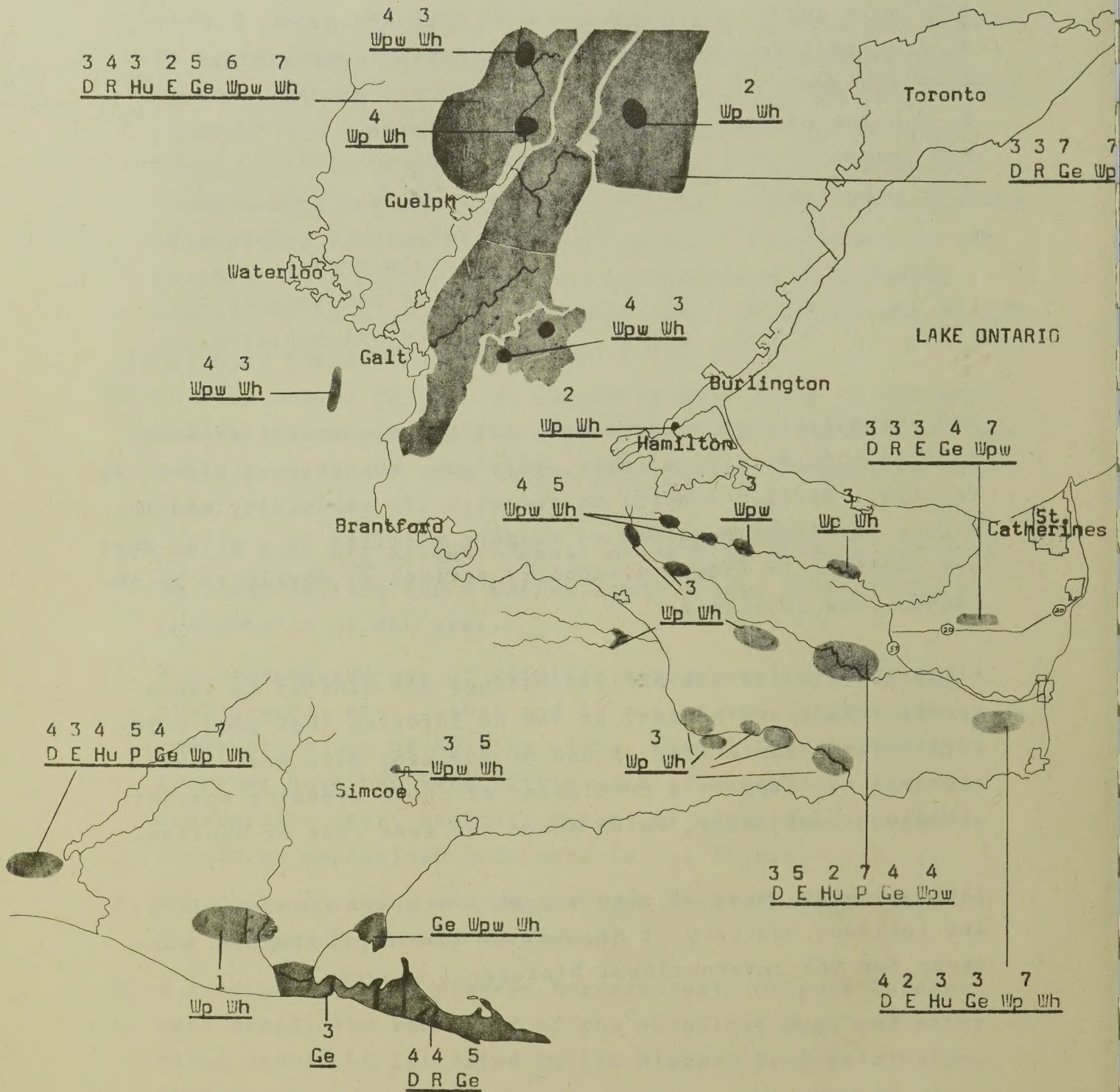
1 -- highest rating	D -- Deer
2 -- very good	E -- European hare
3 -- average to good	Hu-- Hungarian partridge
4 -- average	R -- Ruffed grouse
5 -- below average	P -- Pheasant
6 -- poor	Ge-- Geese
7 -- unsuitable	Wp-- Waterfowl production
	Wpw- Waterfowl; puddle and wood duck
	Wh --Waterfowl hunting
	Wpwh-Waterfowl hunting; (puddle and wood duck)

The suitability of an area for wildlife production depends upon soil fertility, climate, moisture, topography, and other factors. Earlier studies on the wildlife capability and the degree of effort required to support wildlife in a given area are combined in these suitability ratings as developed by the Canada Land Inventory.

Although wildlife suitability ratings are limited to these species which are hunted, it can be inferred that good wildlife habitat for ruffed grouse or for deer also means that the area can support a complement of those predator species as owls, foxes, etc., which share the same type of habitat.

The following pages of site descriptions and species lists are included courtesy of Mr. Ian Macdonald, biologist, surveyor for the International Biological Program.

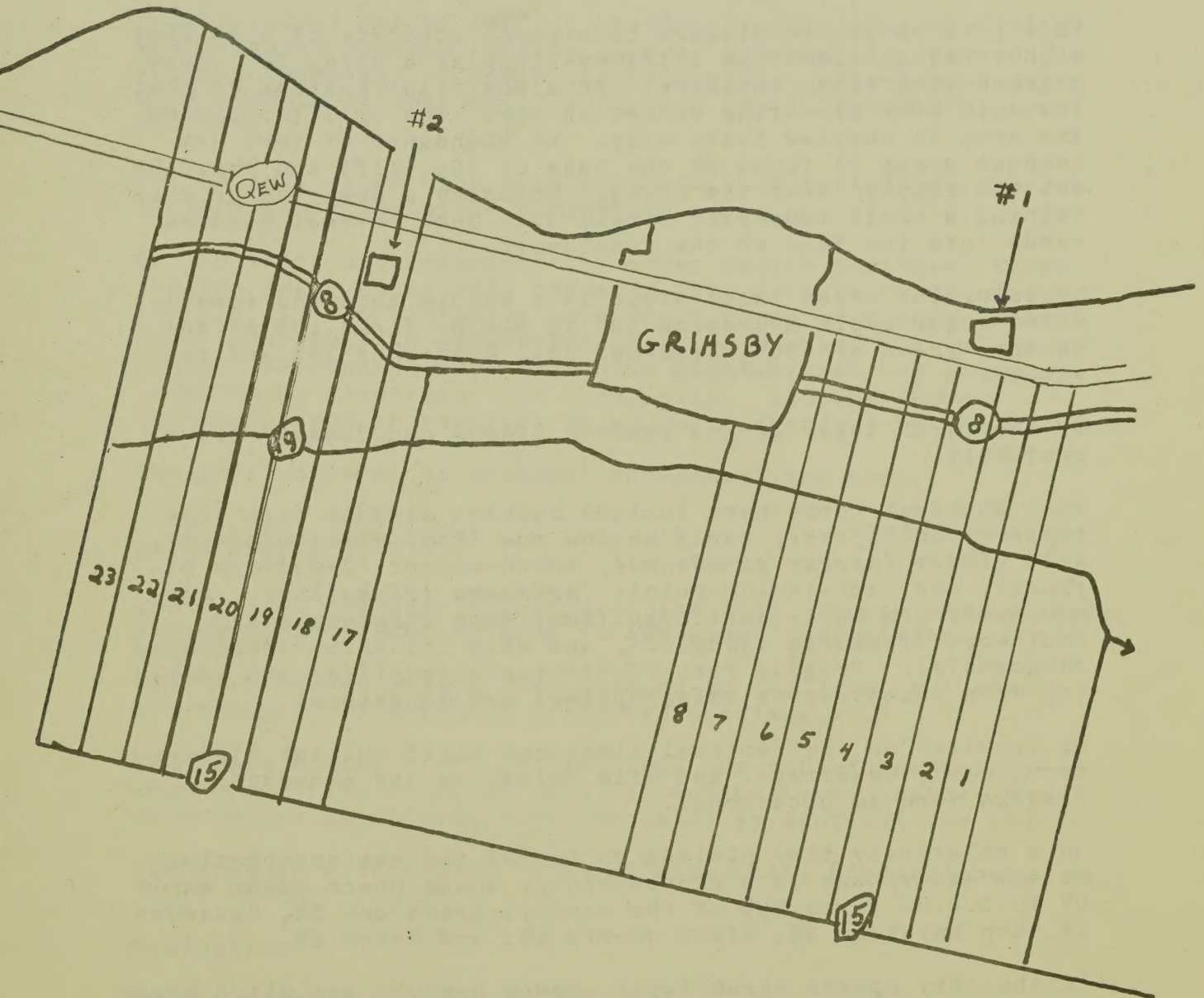
DEPARTMENT OF LANDS AND FORESTS
WILDLIFE SUITABILITY RATINGS



* as developed by Canada Land Inventory

APPENDIX II

INTACT MATURE WOODLOTS WITHIN GRIMSBY
CITY LIMITS (see page 306)



UNIQUE NATURAL AREAS - DETAILED SPECIES LISTING

CAVE SPRINGS ESCARPMENT - NIAGARA WEST (26-28/778-790)
Lincoln County, Clinton Township

This portion of the Niagara Escarpment consists of a 20 foot high vertical limestone cliff overlooking a steep 60° slope covered with talus boulders. An almost flat plateau of shallow soil over limestone occurs on top. The soil throughout the area is shallow heavy clay. An abundance of very wet seepage areas is found at the base of the cliff and throughout the slope. Near the western boundary a deep ravine containing a small temporary stream cuts back several hundred yards into the face of the escarpment.

Covering the steep talus slope is a mature hardwood forest where sugar maple averaging 10" in D.B.H. forms 50% of the canopy, green ash 20%, basswood 15%, butternut 10% and red elm 3%.

In the shrub layer ground hemlock (*Taxus canadensis*) grows profusely.

Very abundant herbs here include bulblet bladder fern (*Cystopteris bulbifera*), early meadow rue (*Thalictrum dioicum*), wild ginger (*Asarum canadense*), touch-me-not (*Impatiens biflora*), and jack-in-the-pulpit (*Arisaema triphyllum*). Common herbs are early saxifrage (*Saxifraga virginensis*), toothwort (*Dentaria diphylla*), and wild columbine (*Aquilegia canadensis*). Fragile fern (*Cystopteris fragilis*) and walking fern (*Camptosorus rhizophyllus*) are occasional.

In crevices on the vertical limestone cliff bulblet bladder fern, early saxifrage, and wild columbine are abundant. Fragile fern is occasional.

On a relatively flat plateau on top of the eastern portion of the escarpment is a closed canopy woods where sugar maple 6" in D.B.H. forms 90% of the canopy, green ash 5%, basswood 2%, hop hornbeam 2%, black cherry 1%, and beech 1%.

In the very sparse shrub layer ground hemlock and witch hazel (*Hamamelis virginiana*) are occasional.

Very abundant herbs in this community include touch-me-not and blue-stemmed goldenrod (*Solidago Caesia*). Zigzag-stemmed goldenrod (*Solidago flexicaulis*), wake robin (*Trillium erectum*), solomon's seal (*Polygonatum pubescens*) and early meadow rue are common. Pokeweed (*Phytolacca americana*) is occasional.

For the most part the woods on the western part of the plateau

lacks a closed canopy and the shrub layer is consequently quite dense. Of the scattered trees sugar maple is 70% dominant, green ash 10% and hop hornbeam 10%.

Very abundant shrubs include bladdernut (*Staphylea trifolia*), round-leaved dogwood (*Cornus rugosa*) and panicle dogwood (*Cornus racemosa*). Common shrubs are alternate-leaved dogwood (*Cornus alternifolia*) and witch hazel (*Hamamelis virginiana*).

In the herb layer blue cohosh (*Caulophyllum thalictroides*) is very dense and often dominant.

On the sides and bottom of the steep ravine scattered trees include sugar maple 60%, basswood 20%, butternut 10%, and red elm 5%. An extensive very dense stand of Canada waterleaf (*Hydrophyllum canadense*) occupies much of the valley floor. Maidenhead fern (*Adiantum pedatum*) and hog peanut (*Amphicarpa bracteata*) are occasional. Ginseng (*Panax quinquefolium*) is reported to be quite abundant in the ravine.

The grey squirrel is abundant throughout the area.

Disturbances

The plateau has been cut-over in the past, though not severely enough to do permanent harm to the plant communities.

Many introduced plants have escaped to the area, but these occur mainly in severely disturbed openings.

The Bruce Hiking Trail passes along the top of the escarpment here. The trail is used by back-packers, horses, and motorcycles but little disturbance is evident off the trail.

The area is a favourite haunt of botanists, bird-watchers, etc.

Evaluation

Cattle have been kept out of the area in the past due to the hazardous terrain; the herb layer is consequently fairly intact.

Local naturalists regard Cave Springs as the least disturbed and best remaining example of the typical plant communities of the portion of the Niagara Escarpment occurring in the Niagara Peninsula.

WAINFLEET MARSH AND PEAT BOG - WELLAND WEST (41/54)
Welland County, Wainfleet Township

This is an extensive wetland of deep peat formation over heavy clay. The water level has fallen considerably due to recent draining but abundant water still remains in the marginal fen where the peat is very shallow. Drainage ditches are located around the edges of the area.

In the central shrub zone leatherleaf and high-bush blueberry are co-dominant. Other common shrubs are black chokeberry, bog laurel, bog cranberry (*Vaccinium oxycoccus*), and mountain holly. Labrador tea and sheep laurel are occasional.

Herbaceous plants found here include Virginia chain fern (*Woodwardia virginica*), hare's-tail cotton grass (*Eriophorum spissum*), pitcher plant (*Sarracenia purpurea*) and reed grass (*Phragmites communis*).

The two mosses, *Sphagnum* and haircap moss (*Polytrichum juniperinum*) form a continuous mat beneath the shrubs.

In the eastern part of the bog is a dense stand of young trembling aspen about 3 feet high. These became established when the water level fell.

Shrubs noticed in this section include black chokeberry, southern arrowroot, and high-bush blueberry.

Occasional herbs are bristly sarsaparilla (*Aralia hispida*), cinnamon fern (*Osmunda cinnamomea*), and Virginia chain fern (*Woodwardia virginica*).

On the periphery of the bog is a marshy fen where cattail and willow are co-dominant.

A large skin of an Eastern Mississauga Rattlesnake was found in the bog. An isolated population of this species has lingered on here.

Disturbances

The ecology of the bog has been gravely disturbed in recent years. Drainage ditches have lowered the water level, encouraging the encroachment of trembling aspen.

In the western end, the surface layers of sphagnum have been removed by a peat company and many additional acres to the east have been burned to destroy shrub growth.

Evaluation

This bog is unique in Southwestern Ontario. It would be a great tragedy if it were completely destroyed. Judging from recent developments, this seems highly probable, unless immediate action is taken. The eastern section of the bog is still relatively intact. If the water level were raised at once, succession would be reversed and the bog saved.

MARSHVILLE STATION CLAY PLAIN - WELLAND WEST (31/58) Welland County: Wainfleet Township

This area is a very wet heavy clay plain, containing many shallow ponds 6" - 12" deep. A few logging trails pass through the stand.

Silver maple, averaging 12" in D.B.H. form 80% of the canopy, green ash 10%, giant white oak 5%, American beech 5%, red oak 5%, pin oak 2%, swamp white oak 2%, shagbark hickory 2% and yellow birch 2%. Very many exceptionally large specimens of silver maple, white oak, and red oak often reaching diameters of over 30" are scattered throughout the area west of the road. East of the road trees are considerably smaller and beech is more abundant, though silver maple is still dominant. Pin oak is especially abundant around the edges of the woods.

High-bush blueberry (*Vaccinium corymbosum*) is the most abundant shrub west of the central tote road. Spicebush (*Lindera benzoin*), southern arrowwood (*Vivurnum dentatum*) and blue beech (*Carpinus caroliniana*) are common.

East of the road in places where the soil is not quite as wet, witch hazel (*Hamamelis virginiana*) and winterberry (*Ilex verticillata*) are occasional.

West of the road very abundant herbs include marsh fern (*Dryopteris thelypteris*), royal fern (*Osmunda regalis*), cinnamon fern (*Osmunda cinnamomea*), sedges (*Carex* spp.), heart-leaved aster (*Aster cordifolius*), touch-me-not (*Impatiens biflora*) and ciliated aster (*Aster ciliolatus*). Indian cucumber root (*Medeola virginiana*), false lily-of-the-valley (*Maianthemum canadense*), jack-in-the-pulpit (*Arisaema triphyllum*) and turtlehead (*Chelone glabra*) are occasional. Shallow ponds here are covered with duckweed (*Lemna minor*).

East of the tote road the presence of a younger woods with more clearings accounts for a greater diversity of plant species.

Ciliated loosestrife (*Lysimachia ciliata*), bellwort (*Uvularia sessilifolia*), New York fern (*Dryopteris noveboracensis*), Christmas fern (*Polystichum acrostichoides*) and marginal wood fern (*Dryopteris marginalis*) are abundant. Hay-scented fern (*Dennstaedtia punctilobula*), grape fern (*Botrychium dissectum*), and bristly sarsaparilla (*Aralia hispida*) are occasional.

A heronry of great blue herons is present in the east section of the woods. Due to the dense foliage only one nest was seen but six adult birds were counted.

Disturbances

The area east of the tote road was heavily logged in the past and as a result trees there are much smaller and denser than in the western section.

West of the road about 100 large white and red oak averaging 30" in D.B.H. were cut last winter.

Evaluation

The west section contains the greatest number of exceptionally large specimens of silver maple, white oak and red oak seen by the surveyor in the Niagara Peninsula. Though 100 trees have recently been cut, more than 400 similar ones remain (figures obtained from the owner). This part also contains a heronry, a rarity today in southwestern Ontario.

Diversity of fern species, both in the west and east parts, is exceptional. Hay-scented fern (*Dennstaedtia punctilobula*) is extremely rare in Southwestern Ontario.

MOFFAT MARSH - GALT EAST (75/15) Wellington County, Ontario

This area is located about nine miles to the southeast of Guelph and is owned partly privately and partly as a section of the Wellington County Forest. The area is situated as a large, roughly oval-shaped, low wet depression on the imperfectly drained gravelly loam of the Burford soil series between the Galt Moraine and the Guelph Drumlin Hills. A stream flows south through this basin but road building across its midpoint and the southern end has caused extensive flooding of the area that has recently affected its vegetation formations.

The main part of the area is a wetland that is construed as a mosaic of scrubland and open marsh-like formation. The vast areas of wet and semi-emergent scrubland are composed of a closed upper story of crack willow (*Salix fragilis*), red osier and grey dogwoods (*Cornus stolonifera*, *C. racemosa*) and scattered trees of white birch (*Betula papyrifera*) and red maple (*Acer rubrum*). Under these shrubs is a poor, semi-open groundcover of swamp grass (*Poa palustris*), cut-grass (*Leersia oryzoides*), hore-hound (*Lycopus virginianus*), beggar's-tick (*Bidens comosa*), swamp aster (*Aster puniceus*) and many other wetland species. Most of these herb species are lent to the area by the open marsh association between the shrubs and the larger open areas. In addition to the matted "meadows" of swamp grass and cut-grass are marsh species such as cattail (*Typha latifolia*), swamp milk-weed (*Asclepias incarnata*), bulrush (*Scirpus atrovirens*), bone-set (*Eupatorium perfoliatum*), etc. In this scrub-marsh complex, the area to the north of the county road is the least mature, resulting from the flooding of the area when the road was constructed. To the south of this road is a well established scrubland, and still further south of this beyond a corridor of trees is a scrub swamp that has a more bog-like aspect, there being species such as Greenland tea (*Ledum groenlandicum*), and sphagnum moss locally forming a dominant phase in the association that elsewhere occurs only along its eastern wooded edges.

South of the county road forming a deep fringe and corridor about this last-described phase is an old, semi-open swamp of silver maple (*Acer saccharinum*), white birch, and white elm (*Ulmus americanum*) with a closed shrub understory of alder (*Alnus rugosa*), alder-leaved buckthorn (*Rhamnus alnifolius*), red osier, and willow. There is a richer ground cover than the scrub zone that contains as well more shade tolerant species such as bog hemp (*Boehmeria cylindrica*), clear weed (*Pilea pumila*), joe-pye-weed (*Eupatorium maculatum*), and deadly nightshade (*Solanum dulcamara*). This association is probably the result of flooding, caused by the construction of Highway 401, that has allowed the shrubs to close in underneath the canopy of dying trees.

Bordering on the scrubland to the north of the county road is a semi-closed wet young forest of 40% white birch, 40% white cedar (*Thuja occidentalis*) and 20% aspen (*Populus tremuloides*). There are only scattered shrubs of grey dogwood, fire cherry (*Prunus virginiana*), saplings of ash (*Fraxinus pennsylvanicus*), and Greenland tea (*Ledum groenlandicum*), and elderberry (*Sambucus pubens*) but a rich, closed ground-cover of bulblet fern (*Cystopteris bulbifera*), swamp carpet (*Chrysosplenium americanum*), marsh fern (*Thelypteris palustris*), mosses and liverworts, wild sarsaparilla (*Aralia nudicaulis*), and virgin's bower (*Climatis virginiana*). There are many noticeable bog

species present here which may attest to the original condition of the area.

To the east of this area is a closed intermediate forest of 80% white cedar, and frequent trees of balsam fir (*Abies balsamea*), and black spruce (*Picea mariana*) that has a closed boreal ground cover composed mostly of mosses, especially on the many fallen cedar logs, and boreal species such as twin-flower (*Linnaea borealis*), naked mitrewort (*Mitella nuda*), blue-bead lily (*Clintonia borealis*), starflower (*Trientalis borealis*), wild sarsaparilla, and alpine enchanter's nightshade (*Circaea alpina*). Here the stream flows under the roots and stumps that expose a rich black peat soil. This woods is probably a remnant of the original state of the area and is one of the best developed "boreal" woods that I have seen in this area.

The Lands and Forests manages a plantation to the west and a hardwood woodlot to the north of this area but its ownership is not clear at this time. The area is an excellent example of different stages of succession from bog to scrub-wetland to swamp. It also contains an excellent if small remnant of the original bog forest of the basin. It is one of the larger wetland scrub areas typical of this locality and has been studied by H. M. Dale of the University of Guelph for its successional soil relations.

ROSEVILLE SWAMP - GALT WEST (96/00-03) Waterloo County, Ontario

This flat, wet, forested area is located about four miles to the west of Galt near Highway 401. It is situated along the eastern edge of the gently rolling Waterloo Sand Hills as part of an old spillway bed. It has a thick peat soil that overlies the stratified gravel of the Burford loam which stretches to the east as a relatively flat plain. Two streams find their headwaters here, one flowing to the south, the other to the north via a ditch that protrudes into the northeasterly section of the area. The vegetation along the streams and in the northern parts of the area is a moderately disturbed cedar-hemlock-maple swamp. In the rest of the area is a maple-birch-elm swamp forest that has been so severely lumbered over the years that the regeneration patterns show up on aerial photographs as many long strips in the canopy. As well, scattered throughout this area are infrequent remnants of the maple-beech-birch forest that probably was once the natural condition of this latter area. These associations are usually quite inhomogenous and a very broad classification

concept has been employed to clarify those present in this area.

The northern third of the area is a fresh to wet, intermediate forest mostly of white cedar (*Thuja occidentalis*) but generally with scattered red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanicus*), white birch (*Betula papyrifera*) and local concentrations of hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*) and tamarack (*Larix laricina*), especially along the stream edge. Generally, there is a semi-closed shrub story of mountain maple (*Acer spicatum*), elderberry (*Sambucus canadensis*), alternate-leaved dogwood (*Cornus alternifolia*), yew (*Taxus canadensis*), and saplings of cedar with a semi-closed ground cover of herb species such as foam flower (*Tiarella cordifolia*), water-pennywort (*Hydrocotyle americana*), bed straw (*Galium triflorum*), bulblet fern (*Cystopteris bulbifera*), pink flowered shin-leaf (*Pyrola asarifolia*), lady-fern (*Athyrium filix-femina*), running and shining clubmosses (*Lycopodium clavatum*, *L. lucidulum*) and, on the logs littering the ground, carpets of mosses, twin-flower (*Linnaea borealis*), and trailing abrutus (*Epigaea repens*). Along the stream edge in the less disturbed sections is a rather dense, coniferous canopy of cedar and hemlock that has a closed ground cover of mosses and liverworts, bulblet fern, and sedges (*Carex* spp.) that cover the peaty soil right up to the stream edge. Scattered elsewhere away from the stream's influence are small, very dense stands of cedar and tamarack that have completely bare ground under them. This association is possibly the least disturbed in the area and is typical of that association following the stream that flows south from this area to Ayr in which the Kitchener-Waterloo Field Naturalists Club has bought a small 20-acre lot.

In the southern two-thirds of this peatland is a swamp forest of silver maple (*Acer saccharinum*), yellow birch (*Betula lutea*), white elm (*Ulmus americana*), green ash, and local concentrations of red maple, hemlock and aspen (*Populus tremuloides*). There is a variously open to semi-closed understory of grey dogwood (*Cornus racemosus*), mountain maple red-berried elder (*Sambucus pubens*), raspberry (*Rubus* sp.) and saplings of cedar and the canopy species. The semi-closed ground cover is indicative of a perennially moist swamp forest, containing herb species such as sedge hummocks (*Carex* spp.), sensitive fern (*Onoclea sensibilis*), foam flower, the spinulose and crested shield-ferns (*Dryopteris austriaca*, *D. cristata*), bunchberry, lady fern and others. Of particular note is the eastern side of this association which has a closed ground cover of yew which excludes almost all other herbs and shrubs creating a perennially green carpet under these trees. It should be noted that the fringes of this forest, especially

on the east, are flooded by the water table all year round. As a result elm was the dominant species which, due to the blight, have been killed. Subsequently there are frequent old swamp succession stages where only a few dead trees are left standing over a solid shrub canopy of grey dogwood, gooseberry (*Ribes sp.*), raspberry, pussy willow (*Salix discolor*), and marshy herbs such as joe-pye-weed (*Eupatorium maculatum*), goldenrod (*Solidago altissima*), stinging nettle (*Laportea canadensis*), false nettle (*Boehmeria cylindrica*), sensitive fern, and ostrich fern (*Matteuccia struthiopteris*).

On the western half of this deciduous swamp forest are scattered hardwood forests composed of sugar maple (*Acer saccharum*) yellow and white birch, white pine and hemlock, some of which reach a diameter of 22 inches dbh., but are usually only about 8 inches dbh. As well, there are scattered trees of black cherry (*Prunus serotina*), red maple, basswood (*Tilia americana*) and beech (*Fagus grandifolia*). There is a semi-open shrub cover of mountain maple and saplings and a semi-closed ground cover of sedge (*Carex pedunculata*, *C. plantaginea*), gold thread (*Coptis trifolia*), gay-wings (*Polygala paucifolia*), maidenhair fern (*Adiantum pedatum*), spinulose shield fern, blue-bead lily (*Clintonia borealis*) and wild ginger (*Asarum canadense*), virginia grape fern (*Botrychium virginianum*), Canada violet (*Viola canadensis*) and purple trillium (*Trillium erectum*). These areas seem to grow on slight rises that are probably remnants of the sand hills that lie below this forest's immediate substrate of deep fresh peat. These areas have been continually lumbered as indicated by the much-used logging roads that lead directly to them.

White-tailed deer are so plentiful in this area that an open season is periodically allowed in this locality. The area is reported to be a nesting place for summer water-thrushes and several other warblers. Although this area has been generally lumbered for over the past 70 years, it not only still contains many interesting plant and animal species, but it is one of the largest swamp forest complexes in the general vicinity. The only current lumbering operations are on a small scale in the northeastern section of the area. The area has been subdivided into many 20-acre lots supposedly valued at \$2000 each, making it a very difficult place to acquire as a whole. The Grand River Conservation Authority, as well as the local naturalist club, are interested in seeing this splendid complex preserved. For our purposes, the area is large enough to harbour untampered-with experimental plots although the state of disturbance of the area would restrict the range of studies that could be carried out here.

LESTER'S (RIED'S) LAKE - GALT WEST (449/965)
 Waterloo County, Ontario

This is a privately owned bog forest and lake complex located about five miles to the West of Galt on the eastern edge of the Waterloo Sand Hills kame moraine. The area is situated as a 40-foot deep, short, narrow valley opening to the south between two lobes of the kame moraine. The valley is bounded by steep slopes on its north and west, gentler slopes on the east, and is almost level on the south sides. There is a stream that flows southward through the area forming a small marly pond near the centre. The valley is occupied by an excellent bog forest, has a beech-maple woodlot on its east and north and is surrounded by moderately rolling to flat terrain that is cultivated.

On the moderate well drained east and north slopes of the valley is a horseshoe shaped intermediate woodlot composed of equal portions of beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*) and black cherry (*Prunus serotina*) and scattered white pine (*Pinus strobus*), and poplar (*Populus grandidentata*) that average 1 inch in diameter. This woodlot has neither shrub nor sapling stratum and only a very poor open ground cover of sedge (*Carex pensylvanicum*), and herb-robert (*Geranium Robertianum*), probably as a result of indiscriminate grazing practices in the area.

To the west of this association occupying over half of the remaining area of the moist valley bottom is a swamp forest of 60% white cedar (*Thuja occidentalis*), 30% yellow birch (*Betula lutea*) and 10% white pine. There is an open understory of only scattered shrubs of spicebush (*Lindera benzoin*) and saplings of cedar. The closed ground cover is very rich containing species indicative of southern Ontario lowland swamp forests such as foam flower (*Tiarella cordifolia*), sedge (*Carex pedunculata*), interrupted fern (*Osmunda Claytoniana*), and Jack-in-the-pulpit (*Arisaema triphyllum*). This association has a substrate of a foot or so of mucky peat overlying poorly drained medium sand. Occasionally there are small "islands" of sand that rise above the muck and support an extremely rich beech-maple-cedar association with herbs in addition to those mentioned such as partidgeberry (*Mitchella repens*), shining club-moss (*Lycopodium lucidulum*), wintergreen (*Gaultheria hispida*), especially on fallen logs, gold thread (*Coptis trifolia*), blue bead lily (*Clintonia borealis*), and fringed gay-wings (*Polygala paucifolia*). This phenomenon is predominant in the eastern areas where it creates a most pretty mosaic effect. As well there are local flooded sections with many windfalls that support carpets of liverworts and mosses as well as creeping snowberry (*Gaultheria*

hispidula) and sedge (*Carex disperma*). Where the stream enters the bog at the northern arm of the valley is a small opening with open wetland species such as sticky goldenrod (*Solidago patula*), skunk cabbage (*Symphoricarpos foetidus*), water-carpet (*Chrysosplenium americanum*), bulrushes (*Scirpus* spp.) and sedges.

In the southern half of the bog is a small open marl lake about 10 feet deep that has only *Chara* sp. growing on its bottom. Along its edge of marly clay is a narrow margin of twig-rush (*Cladium mariscoides*), bulrush (*Scirpus validus*), grass of parnassus (*Parnassia glauca*), cranberry (*Vaccinium macrocarpon*), and sphagnum moss and scattered trees of tamarack (*Larix laricina*) and shrubs of red-osier (*Cornus stolonifera*). This lake has a small dock and boat house on it and is probably used by the owner as a hunting area in the fall since it is doubtful that fish would survive in this pond.

Bordering the northern edge of the lake and extending well back into the swamp forest is a closed mature woodlot of 90% cedar, 10% larch that has two phases. The first has an almost completely open and dry solid ground cover except for occasional bunchberry (*Cornus canadensis*), creeping snowberry and sedge (*Carex disperma*). This association has a substrate of mucky peat that overlies marl that overlies sand.

Surrounding the valley are old fields at an early successional stage. On the tops of the slopes to the west and south of the bog valley are thickets of staghorn sumac (*Rhus typhina*), and raspberry (*Rubus strigosus*), scattered trees of hawthorn (*Crataegus* sp.) and poplar (*Populus grandidentata*), and herbs such as Kentucky blue-grass (*Poa pratensis*), goldenrod (*Solidago canadensis*), poison ivy (*Rhus radicans*) and scouring rush (*Equisetum hyemale*) as well as persisting forage crops.

This area is an excellent if somewhat small example of the cedar bog forest formations and their transitions to upland cedar swamp forest. The area is privately owned and is operated as a private hunting(?) club. There is no damage done to the swamp forest association from this activity and there is no immediate danger of disturbance in this area.

PARIS CRANBERRY BOG - GALT WEST (53/94) Waterloo County, Ontario

This area is located about four miles to the southwest of Galt on a gently rolling clay till in the area between the Galt and Paris Moraines. The area is a large shallow kettle hole that has poor drainage and acts as a catch basin for the surrounding

adjacent farmlands. The area contains an extensive open bog that has a fen-like phase with a fringe of scrubs on its edges and woodlots on its surrounding uplands. This privately owned bog is harvested annually for its plentiful cranberries and is well known to naturalists from all over southern Ontario as an area of great natural interest.

In the basin is a large open hummock bog of leatherleaf (*Chamaedaphne calyculata*), bog rosemary (*Andromeda glaucophylla*), Greenland tea (*Ledum groenlandicum*), bog willow (*Salix glaucophylloides*), and sphagnum moss that has very scattered stunted trees of red maple (*Acer rubrum*), white pine (*Pinus strobus*) and tamarack (*Larix laricina*). Throughout most of the bog is a rich herbaceous species complement of ubiquitous cranberry (*Vaccinium macrocarpon*, which is locally dominant), twig rush (*Cladium mariscoides*), marsh fern (*Thelypteris palustris*), bog sedge (*Carex lasiocarpa* var: *americana*), Ohio goldenrod (*Solidago ohioensis*), white beak-rush (*Rhynchospora alba*) marsh St. John's-wort (*Triadenum Fraseri*), sundew (*Drosera intermedia*), pitcher plant (*Sarracenia purpurea*), linear leaf aster (*Aster junciformis*) and cotton grass (*Eriophorum virginianum*). Near and in the northern arm of the bog, there is a more fen-like aspect with tall bulrushes (*Scirpus* spp.), twigrush and rush (*Juncus effusus*) forming a narrow-leaved sward over the low ericaceous understory. In the southern arm of the basin is a small open pond around which the bog takes on a wetter phase with local cattail (*Typha latifolia*), blue-stem (*Calamagrostis canadensis*), purple cinque-foil (*Potentilla palustris*), three sided sedge (*Dulichium arundinaceum*), and water hoarhound (*Lycopus virginianus*).

Around the edge of the bog area at the limits of the basin is a scattered shrub zone composed of willows (*Salix* spp.), meadow sweet (*Spiraea alba*), buttonbush (*Cephalanthus occidentalis*). This six-foot high fringe is on seasonally inundated muck soil that shows no sign of having a marl substratum. It supports a closed low carpet of blue joint, bulrush (*Scirpus atrovirens*), spike rush (*Eleocharis acicularis*), water hoarhound, marsh calla (*Calla palustris*), rush, yellow cress (*Rorippa islandica*), stranded hornwort (*Ceratophyllum demersum*) and pond weed (*Potamogeton* sp.) and madder (*Galium obtusum*). Of interest in the eastern arm of the basin is a dense scrubland of ten-foot high cuff willow (*Salix rigida*) that has almost no ground cover except for a few mosses, and only a fringe of crack willow trees (*Salix fragilis*) along its northerly sides.

Along the southerly upland edges of the basin is a woodlot fringe that acts as a wind-shield for the fields to the south-east. The eastern half of the fringe has a slightly rolling

terrain of stoney loam that supports an intermediate woodlot association of poplar (*Populus grandidentata*), black cherry (*Prunus serotina*), and sugar maple (*Acer saccharum*). It has a semi-closed shrub cover of witch-hazel (*Hamamelis virginiana*) and black cherry saplings and a rather open ground cover of typical woodland species such as sedge (*Carex pensylvanicus*), polypody fern (*Polypodium virginianum*), spinulose wood fern (*Dryopteris spinulosa*) and enchanter's nightshade (*Circaea quadrisulcata*). Overlooking the souther-most edge of the basin is a narrow fringe woodlot of red oak (*Quercus borealis*) and red maple with infrequent large white pine. This has a semi-closed shrub cover of arrow root (*Viburnum Rafinesquina-num*), hazel nut (*Corylus cornuta*) and serviceberry (*Amelanchier laevis*) with a poor ground cover of sedge and hepatica (*Hepatica americana*). Both of these associations are rather poor in species composition and maturity probably due to the insidious cattle grazing and occasional thinning that occurs. Nevertheless, they do provide a vantage point for viewing the bog and diverse backdrop as well.

This bog merits formal preservation as a natural area because it is one of the better and certainly the largest open bogsto be found in the locality. The casual cranberry harvesting is not doing any serious damage to the bog although some effect would inevitably be seen if the harvest procedure were intensified. This area is adjacent to the Sudden Woods and Miller's Lake areas and the Grand River Conservation Authority and Kitchener-Waterloo Field Naturalists have both expressed interest in acquiring the area for the purposes of preserving its present state.

DICKSON WILDERNESS AREA SAND RIDGES AND MARSH - GALT WEST (47/91) Waterloo County, North Dumfries Township

In this area 40 foot-high sand ridges lie on three sides of a marshy depression. A small pond is also found on top of one ridge.

In most of the lowland, tamarack, growing on deep black muck, forms about 70% of the canopy. Silver maple makes up 10% of the tree layer, white cedar 5%, black ash 5%, white elm 5%, trembling aspen 5%, and white pine 2%.

Panicle dogwood (*Cornus racemosa*) is the dominant shrub. Red osier (*Cornus stolonifera*) and winterberry (*Ilex verticillata*) are also very abundant. Silky dogwood (*Cornus Amomum*), nannyberry (*Viburnum lentago*), Canada elder (*Sambucus canadensis*),

Virginia creeper (*Parthenocissus quinquefolia*), willow (*Salix* spp.) and meadowsweet (*Spiraea alba*) are common. Beaked hazel (*Corylus cornuta*) is occasional.

In the herb layer touch-me-not (*Impatiens biflora*) and skunk cabbage (*Symplocarpus foetidus*) are most abundant. Sensitive fern (*Onoclea sensibilis*), marsh fern (*Dryopteris Thelypteris*) and ciliated loosstrife (*Lysimachia ciliata*) are common. Cinnamon fern (*Osmunda cinnamomea*), water hemlock (*Cicuta bulbifera*) naked mitrewort (*Mitella nuda*), common skullcap (*Scutellaria galericulata*), and mad-dop skullcap (*Scutellaria lateriflora*) are occasional.

On the sand ridges is a closed canopy hardwood forest where red oak forms 30% of the canopy, red maple 30%, largetooth aspen 10%, red hickory 5%, white oak 5%, and black cherry 2%. Sassafras, black oak, and sugar maple are occasional. The average D.B.H. of the trees here is 8".

In the shrub layer hop hornbeam (*Ostrya virginiana*) is common along with witch hazel (*Hamamelis virginiana*), American hazel (*Corylus americana*) and blueberry (*Vaccinium angustifolium*).

Dominant herbs here are wild sarsaparilla (*Aralia nudicaulis*) and large-leaf aster (*Aster macrophyllus*). False lily-of-the-valley (*Maianthemum canadense*), wintergreen (*Gaultheria procumbens*), hog peanut (*Amphicarpa bracteata*) and early meadow rue (*Thalictrum dioicum*) are common.

Indian pipe (*Monotropa uniflora*), rue anemone (*Anemonella thalictroides*), round-leaf pyrola (*Pyrola rotundifolia*), tick-trefoil (*Desmodium glutinosum*), tick-trefoil (*Desmodium* sp.) and interrupted fern (*Osmunda Claytoniana*) are occasional.

In the small pond on top of one of the ridges, a narrow fringe of cattail (*Typha latifolia*) grows around the shores. White water lily (*Nymphaea odorata*) is common in the open water throughout most of the pond.

Abandoned fields on the fringes of the hardwood community are being invaded by many species of herbs, shrubs, and trees. New Jersey tea, American hazel, and round-leaved dogwood are abundant shrubs. Saplings of largetooth aspen are beginning to overtop the shrub community. Herbs here include several species of grass and bush clover.

In the south end of the lowland is a small pond approximately 100 feet in diameter surrounded by a floating peat mat.

The pond itself is covered with duckweed (*Lemna minor*).

A 10 foot wide dense fringe of water willow borders the open water.

Behind the water willow is a solid mat of sphagnum. Leather-leaf, bog false Solomon's seal, bog bean, and pitcher plant are found among the sphagnum.

Disturbances

Considerable evidence of past logging is present in the hardwood community. Trees here are medium-size, averaging only 8" in D.B.H.

Nature trails wind through all the communities except the sphagnum bog. In most cases users remain on the trails and little disturbance is noticeable elsewhere.

A commercial camp ground and bathing beach (privately owned) lies only 200 yards east of the wilderness area; however, the property is well fenced and no sign of trespassing is evident.

Evaluation

The hardwood community is similar in many ways to the one at Pinehurst Conservation Area; however, the tamarack fen and the small sphagnum bog considerably embellish the Dickson Wilderness Area, giving it considerably more diversity of habitat than is found at Pinehurst. Several uncommon and rare orchids (not seen by the surveyor) occur in these wetland communities the Kitchener-Waterloo Naturalist Club is currently composing a special list of the area.

OLIVER'S BOG - GALT WEST (59/97) Waterloo County, Ontario

Located on the western edge of the Galt Moraine about two miles to the southeast of the city of Galt is a large (42 acres) kettle hole that contains an excellent example of a classical kettle-hole bog. This privately-owned 20-foot depression acts as a drainage basin for the immediately surrounding area, an intermittent creek draining into it from the east in the spring. However, although this area is situated on a normally well-drained, calcareous stoney till, the only drainage from it is via the ground water table. This is a slow process and has resulted in a water-retentive bog that has a non-marly peat muck substrate.

The bog area is bounded on its east and south sides by cultivated fields and on its north and west sides by a heavily grazed woodlot fringe of red oak (*Quercus borealis*), red maple (*Acer rubrum*), white pine (*Pinus strobus*). There is a rather open shrub layer composed of serviceberry (*Amelanchier arborea*), witch hazel (*Hamamelis virginiana*) and buckthorn (*Rhamnus catharticus*) and a somewhat patchy ground cover of Canada blue-grass (*Poa compressa*), poverty-grass (*Danthonia spicata*), Canada May-flower (*Maianthemum canadense*), cat-briar (*Smilax herbacea*) and, surprisingly enough, prairie beard grass (*Andropogon scoparius*). This is a well drained fringe on highly calcareous soil but the only evident predators are cows which indeed frequent all the edges of the bog. However, this raised edge acts as a vantage point for the wetter low areas of the bog.

Around the edge of the bog complex is a shrubby zone of willow (*Salix* sp.), red osier dogwood (*Cornus stolonifera*), button-bush (*Cephalanthus occidentalis*) and, in the eastern edge extending up the bed of the intermittent inflowing stream, an especially fine stand of swamp blueberry (*Vaccinium corymbosum*). This moist fringe area has only weedy and lowland species growing on its mucky soil such as sedges (*Carex* spp.), smart weed (*Polygonum Persicaria*), beggar's tick (*Bidens cernua*), marsh fern (*Thelypteris palustris*) and deadly nightshade (*Solanum Dulcamara*).

The main part of the area is a bog complex that is noteworthy in that it shows the complete classical bog succession pattern - from a kettle hole pond to a bog forest. In the northern arm of the bog is an open pond that is encroached upon by a hummocky blanket of leatherleaf (*Chamaedaphne calyculata*) and sphagnum moss. The pond waters have duckweed (*Lemna minor*) and lily pads (*Nuphar variegatum*) are near its edge while the floating bog edge is quite flooded with frequent plants of cattail (*Typha latifolia*), linear-leaved willow herb (*Epilobium palustre*), purple cinque foil (*Potentilla palustris*), northern St. John's wort (*Hypericum boreale*) and marsh fern in the channels between the springy hummocks. However, as one moves from the pond area to the east there is a marked decrease in these wetland species and a gradual increase in the diversity and richness of bog species. First there is a diffuse band of bog sedge (*Carex lasiocarpa* var. *americana*); behind this are scattered small trees of red maple and winterberry (*Ilex verticillata*). Further back there is a gradual accumulation of cranberry (*Vaccinium macrocarpon*), virginian cotton-grass (*Eriophorum virginianum*), bog sedge (*Carex trisperma*), pitcher plant (*Sarracenia purpurascens*), Greenland tea (*Ledum groenlandicum*) and bog rosemary (*Andromeda glaucophylla*). About half way from the eastern edge there is an increased incidence of stunted black-spruce trees (*Picea mariana*). These

form a small bog forest in the eastern arm that is, along with occasional tamarack (*Larix laricina*) on an apparently solid peat substrate. In this "forest" the trees are closely crowded together and generally there is a very sparse ground cover of sedge (*Carex trisperma*) and adder's mouth orchid (*Malaxis unifolia*) although there are occasional open areas with a solid mat of mosses on the ground. This thicket apparently houses white-throated sparrows and some warblers as well.

Although it is only of moderate size, this area has the best example of a complete classical bog succession that I have seen in the county. Having a natural vantage point from the wooded fringe on the north and west, the area is ideal for an introductory ecology study by intermediate levels of secondary education. The area is completely undisturbed except for the grazing of cattle around the edges, and an apparently abandoned attempt by the farmer to dredge peat muck for fertilizer from the northern edge of the pond. Both of these practises could easily be reconciled if the area were to be leased to the local school boards who wish an easily available and accessible outdoor classroom for their science courses. For this latter purpose the area is ideal. The Kitchener-Waterloo Field Naturalists consider this area to be in immediate danger of destruction and so action should be taken promptly.

OIL WELL BOG - GALT WEST (52/12) Wellington County, Ontario

This area is located about six miles south of Guelph, half-way between this city and Galt. It is situated on a gently rolling sandy loam plain bordering on the northwest edge of the Galt Moraine that extends one hill which divides this low lying area into two parts. The eastern section supports swamp scrub and forest associations; the western section supports these and a degraded bog that at the north side of a road through the whole area is drying up, and on the south side is severely paludified. Dr. H.M. Dale of the University of Guelph has done studies on the vegetation-soil relationships of the transient bog formation. Other people have done studies on the blueberries found here.

The main part of the area is a disturbed bog that shows degrees of its original open form, a drained form, a forested form and a flooded form. On the north side of the road the

bog has an open character with a hummocky shrub mat of leatherleaf (*Chamaedaphne calyculata*), Greenland tea (*Ledum groenlandicum*), blueberry (*Vaccinium myrtilloides*) and swamp laurel (*Kalmia polifolia*) that has a spring cushion of sphagnum moss with bog herbs such as cranberry (*Vaccinium macrocarpon*), bog sedge (*Carex trisperma*), winter-green (*Gaultheria hispida*) and cotton grass (*Eriophorum virginianum*). Towards the edges of this bog is an increased incidence of white pine (*Pinus strobus*) and larch (*Larix laricina*) that on its northern edge forms a bog forest of white pine, white birch (*Betula papyrifera*) and aspen (*Populus tremuloides*). In the understory is a decrease in the open bog species and an increase in those of a bog forest such as huckleberry (*Gaylussacia baccata*), swamp blueberry (*Vaccinium corymbosum*), and wither-rod (*Viburnum cassinoides*), in the shrub story and spinulose and crested shield-fern (*Dryopteris austriaca*, *D. cristata*), Canada May-flower (*Trientalis borealis*) and only occasionally sphagnaceous mosses on the ground. This forest already has a well developed litter horizon that overlies the still-wet peat parent material. The western edge of the open bog shows a deciduous shrub layer advancing over the slower ericaceous bog species; it is composed of huckleberry, mountain holly (*Nemopanthus mucronatus*) and swamp blueberry.

Forming a narrow band that juts into the eastern half of the open bog is a very dense forest of almost pure black spruce (*Picea mariana*) with only an occasional larch. The ground here is almost bare with the exception of mosses, roots of the trees, and frequent potholes of water. This association may have originated around a drainage ditch that was dug partly into the bog and supplied the nutrients required by such an association. Following such a ditch dug more recently on the south side of the road is a younger phase of this bog forest with equal parts of black spruce and larch, still having the original open bog shrub and herb species.

To the south of the road is a "paludified" bog that has been flooded probably by the construction of the road. There are still scattered relicts of the original bog species that form hummocks, such as leatherleaf and sphagnum, but the rise in water level has isolated these hummocks and has allowed shrubs such as willow (*Salix* spp.), winterberry (*Ilex verticillata*), black chokeberry (*Aronia melanocarpa*), meadowsweet (*Spiraea alba*), and alder (*Alnus rugosa*) to become established. Among the sprays of shrubs are only very scattered trees of aspen, birch and red maple (*Acer rubrum*). The hummocks are formed by sphagnum or leatherleaf serving as an evergrowing platform for the wetland shrub species and

on them not only are there some persisting bog species but also some marsh species such as blue-joint (*Calamagrostis canadensis*) and bulrush (*Scirpus* sp.)

Around the edges of this depression is a closed intermediate swamp forest association of elm (*Ulmus americanus*), green ash (*Fraxinus pennsylvanicus*), silver maple (*Acer saccharinum*) and yellow birch (*Betula lutea*). This has a scattered shrub story of young balsam fir (*Abies balsamea*), winterberry, white cedar (*Thuja occidentalis*), red osier (*Cornus stolonifera*). There is a semi-closed ground cover of marsh grass (*Poa palustris*), touch-me-not (*Impatiens biflora*), sedges (*Carex* spp.), marsh milkweed (*Asclepias incarnata*), foam flower (*Tiarella cordifolia*) and other spring swamp species. These swamps occur on a non-organic parent material as contrasted to the bog type formations. One notable exception is what is ostensibly a rather open swamp of this type. However, it grows on a muck that overlies typical bog peat. It contains only a semi-closed tree canopy of aspen, red maple and elm and a closed shrub cover of winterberry, cuff willow (*Salix rigida*), grey dogwood (*Cornus racemosus*), swamp blueberry, young spruce, and stunted black ash (*Fraxinus nigra*). The ground cover is generally flooded and has only scattered wetland herbs.

On the upland areas on the east and west sides of the depression are small woodlots of sugar maple (*Acer saccharum*), beech (*Fagus grandifolia*) and hemlock (*Tsuga canadensis*). They are very disturbed by grazing and thinning and have a poor understory of ironwood (*Ostrya virginiana*) and a depauperate ground cover of woodland sedge (*Carex pensylvanica*), goldenrod (*Solidago caesia* S., *flexicaulis*), and wild ginger (*Asarum canadensis*). Elsewhere around the area are only old fields and pastures.

The area is reputed to hold a population of white-tailed deer. As well, the bog forests have bird species typical of this habitat such as white-throat sparrow, grouse, and warblers. Moreover, the swamp forest may be a nesting place for a small population of yellow-billed cuckoo.

This bog-swamp complex is gradually and possibly inadvertently being drained on its eastern side by a small creek for which this area is the headwaters. This successional complex has been only superficially studied and warrants a more detailed examination to establish the ecological dynamics responsible for the phytosociological alterations. It would be wise to protect this bog from any undue exploitation and to preserve it for this type of study since it is the best example of this transition phase in the locality.

SPRINGVALE CEDAR SWAMP - SIMCOE EAST (719/578)
Haldimand County, Hagersville Township

This seventeen-acre wooded swamp lies in a slight depression in otherwise flat farmland of heavy clay. A perched water table has been created by peat formation and the swamp itself is elevated about two feet above the fields to the north. Several springs are scattered throughout the wetland.

In much of the woodland white elm was dominant or co-dominant with silver maple. With the death of the elm many openings have been created and a closed canopy forest is now rare here. Scattered 12" - 15" diameter silver maple and basswood are the most common trees. Black ash is also fairly abundant. Several very large bur oak 30" in D.B.H. are present. Mountain maple (*Acer spicatum*) is common in the understory along with occasional shrubs of *Cornus stolonifera*, *Cornus Amomum*, *Viburnum trilobum*, *Zanthoxylum americanum*, *Cornus racemosa* and *Ilex verticillata*. Very common woody vines occupying every tree are *Rhus radicans* var. *radicans* and *Parthenocissus quinquefolia*. Commons herbs include *Bidens* (sp.) (4 ft. tall) and *Onoclea sensibilis*. *Actaea rubra* and *Dryopteris cristata* are occasional.

On the south-east edge of the woods is a spring which creates about one acre of extremely wet land. Here *Typha angustifolia* forms a dense, almost pure stand.

North of and immediately adjacent to the cat-tail community is open wet scrub. *Cornus stolonifera* and *Cornus Amomum* form dense thickets here. *Cornus racemosa*, *Rhus Vernix* and *Fraxinus nigra* are occasional.

Along the western edge of the swamp is a closed canopy, tall scrub community where white cedar is 95% dominant but seldom over 15 ft. high. Eastern larch is occasional among the cedar. *Rhus Vernix* is a very common shrub here. *Cornus alternifolia*, *Viburnum lentago* and *Viburnum dentatum* are occasional. In the herb layer, *Cypripedium Calceolus* (variety unknown) and a hybrid *Cypripedium* are common (at least two dozen plants were counted by me in November, 1969).

North and east of the cedar scrub community, the soil is wetter and eastern larch is the sole tree, scattered in a dense shrub community of *Cornus stolonifera* and *Cornus Amomum*. In the herb layer, *Impatiens biflora* forms a thick stand.

About mid-way along the north border of the swamp is a one-acre stand of 6" - 8" diameter closed canopy white cedar.

Several boreal species occur here, including twinflower (*Linnaea borealis*), gold thread (*Coptis trifolia*), bunchberry (*Cornus canadensis*), bulblet bladder fern (*Cystopteris bulbifera*) and yellow lady's slipper (*Cypripedium Calceolus*). Sphagnum occurs occasionally beneath the cedars.

Of the 17 acres of swamp, the white cedar scrub community (about 3 acres in size) and the white cedar forest (about 1 acre) are almost unique in Haldimand County. (According to reliable sources this is the only location of yellow lady's slipper in Haldimand). The rest of the area (13 acres) is rather mediocre deciduous swamp badly disturbed by the death of the white elm.

The 100-acre lot containing the swamp is owned by Charles Pearce, a contractor, who lives on the property. He has built a small sub-division of about 15 houses in a field immediately north of the swamp. He had also hoped to build more houses south-west of the wetland and attempted to drain his south-west field by digging a shallow 1 ft. deep ditch from the cat-tail stand through the middle of the swamp to a 5 ft. wide creek which flows along the north border of the swamp. There is a drop of about 3 inches from this ditch into the creek. Apparently he realizes the ditch is not doing the job intended and is quite willing to have it filled in (this would be a simple matter as it is quite shallow and narrow).

In order to build the sub-division, Mr. Pearce deeded 5 acres of swamp to Walpole Township. He has talked to the reeve and says the Township is quite willing to give the land to anyone who will preserve it. Mr. Pearce himself will donate the rest of the swamp (12 acres). He feels that a fence will be required to keep out people from the sub-division.

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CHAPTER ELEVEN

THE NIAGARA ESCARPMENT

dan gardiner

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INTRODUCTION

The Niagara Escarpment is the largest and most unique natural landform in the otherwise flat landscape of Southern Ontario. It enters the province from the United States at Queenston and follows Lake Ontario, a couple of miles back from the shore, to just west of Hamilton where it buries itself into the landscape and forms the unique Dundas Valley. The Escarpment re-emerges on the opposite side of the valley and twists its way north to just south of Georgian Bay. From there, it heads westward, forming such areas as Beaver Valley and the Blue Mountains, and then moves northward again along the Bruce Peninsula to Tobermory. Here the Escarpment takes a dive into Georgian Bay and re-emerges briefly on the Manitoulin Islands before heading back into the United States.

The recreational capabilities of the Escarpment could be described as infinite. This unique landform in its many shapes from sheer cliffs hundreds of feet high to rolling hills stretches over a mile in width, provides excellent opportunities for almost all forms of recreation, from the most passive uses, such as wildlife and ecological reserves, to the most intensive, such as ski slopes, golf courses, dams and scenic drives.

Adequate planning must be produced now to protect it from ram-paging suburbia. By the year 2000, Ontario is expected to contain a solid band of urbanization ten miles wide, from Oshawa around the lake through Hamilton to Niagara Falls. The Toronto-Centred Region's population (which is roughly from Oshawa to Hamilton) is expected to reach the neighbourhood of eight million by 2000, compared with 3.6 million in 1966.¹

¹ Department of Treasury and Economics, Ontario, *Designs for Development: The Toronto-Centred Region* (May, 1970) p.2.

Add the estimated population of the Niagara Peninsula by the year 2000, and we find a great number of people who will require large amounts of recreational land.

The Niagara Escarpment has been envisioned by numerous people and studies, including the Toronto-Centred Region Plan and the Gertler Report², as the primary nearby recreational area for the entire population of the Niagara Peninsula, including the Hamilton-Burlington area. This study has been written with these points in mind, and the only worry is that the recommendations may be too conservative.

Perhaps the most important point to keep in mind when drawing up plans for the Escarpment was best expressed by Ray Lowes, founder and Secretary of the Bruce Trail Association: "...the entire Niagara Escarpment must be kept as a continuous green belt across the whole of Southern Ontario, from Queenston to Tobermory. We do not want, and cannot be satisfied with token parks set aside here and there..."³

The realization of the uniqueness and importance of the Niagara Escarpment is not new. As far back as 1890, Wilkins read a report before the Hamilton Association on the unique flora, fauna and waterfalls of the Niagara Escarpment in the vicinity of Hamilton.⁴

Likewise, the idea of treating the Escarpment as a complete unit is not new. In 1958 the Tri-County Committee petitioned

² Gertler, L.O., *Niagara Escarpment Study: Conservation and Recreation Report* (Dept. of Treasury and Economics, Ontario, 1968).

³ Lowes, Raymond, in a personal communication to the author.

⁴ Wilkins, D.F.H., *The Niagara Escarpment* (Report read before the Hamilton Association, May 8, 1890).

the provincial government to make the Escarpment, from Queenston to Hamilton, into a continuous provincial park and scenic drive.

In December 1965 they again submitted a petition-brief to the provincial government, petitioning the Department of Highways to support the Scenic Drive proposal.⁶ As a result, funds were made available for an in-depth study⁷ of the Escarpment from Hamilton to Queenston.

These studies made questionable recommendations, such as the small amount of acreage proposed for acquisition, and suggested that restaurants be built at some of the most scenic points, such as Grimsby Point and the Devil's Punch Bowl. The important idea, that the Escarpment be preserved as a continuous green belt and that it be done immediately was, however, presented and stressed.

The *Niagara Escarpment Study: Conservation and Recreation Report* (otherwise known as the Gertler Report),⁸ which could be considered the bible of the Escarpment, was done in 1968 for the provincial cabinet on the entire Niagara Escarpment, and stresses these two very important points, i.e., that the Escarpment be set aside as a continuous green belt and that it be done immediately.

⁵ Tri-County Committee, *Report on the Niagara Escarpment* (1958) p. 49 (copy available at Hamilton Public Library, Main Branch, Reference Dept.)

⁶ ---, *Niagara Escarpment Scenic Drive Proposal* (1966) p. 1.

⁷ *Ibid.*

⁸ Gertler Report, *op. cit.*

THE STUDY AREA

Although the study area of the Eco-Inventory centres around Halton and Wentworth Counties, this section of the report considers the Escarpment lands from Grimsby to the northern part of Halton County, since this represents the area within easy access of Hamilton. Some information has been gathered on the Escarpment in the entire Niagara Peninsula region and is presented in a later section (see page 385).

The Escarpment has been divided into four sections for the purposes of this analysis:

1. Grimsby to the Dundas Valley
2. Dundas Valley to Mount Nemo
3. Mount Nemo to Highway 25
4. Highway 25 to the Halton County Line.

TYPES OF CONTROL OF ESCARPMENT LANDS

There are two basic types of control which should be used in preserving the Niagara Escarpment: ownership and easements.

Ownership

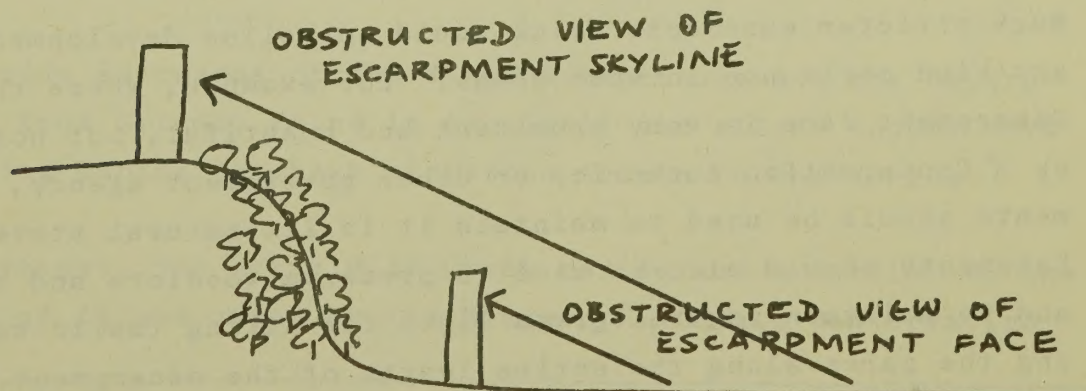
The first means is simply outright ownership of the land by some governmentally-controlled public agency such as a Conservation Authority or the Department of Lands and Forests who would maintain the areas in a natural state. This means of preservation should be used when a maximum amount of control and protection is desired over a specific area of land or landform.

Easements

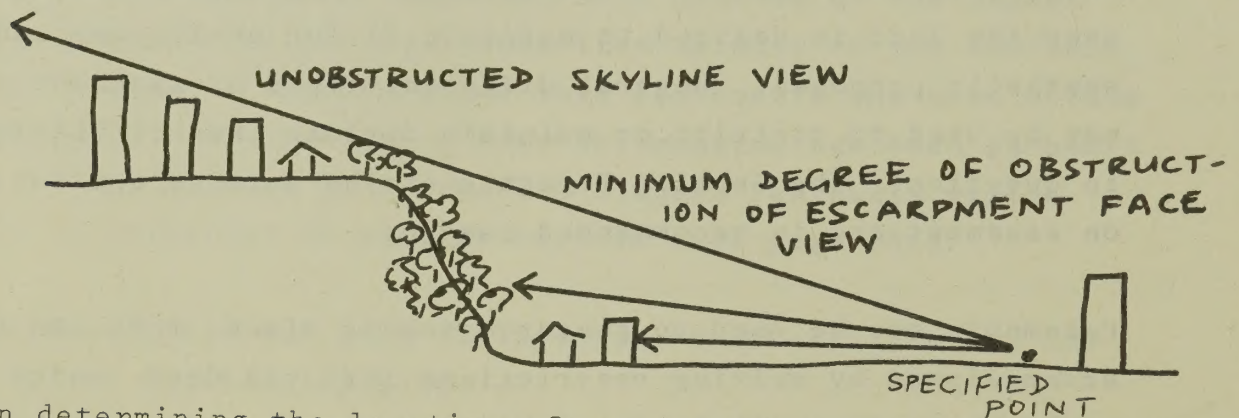
Easements are recommended for use in places where outright ownership of the land is not desirable, primarily because of costs involved. But at the same time, some form of control over the land is desired to maintain it for ecological and aesthetic purposes. Several different types of easement may be used to restrict or maintain certain uses of the land in question. The Gertler Report contains a large section on easement and is recommended reading.

Easements may be used to preserve scenic views; this can be accomplished by writing restrictions into the deed which would state that all lands within the scenic view must be maintained as they are at the time of adding the clause to the deed. This means that a farm under such an easement must be maintained as a farm even if sold. This would disallow such encroachments as suburbs and quarries from moving in to spoil a view.

Scenic easements should not only control the view *from* the Escarpment, but also the view *of* it. It would be undesirable to place a 15-storey building either at the foot of the Escarpment, thus blocking the face view, or on the brim, obstructing the skyline view.



Because of this, easements should also be used to ensure that the skyline and face view of the Escarpment will not be obstructed by any large buildings within the viewing radius of a specified point.



In determining the location of the "specified point", one of the main considerations should be the attractiveness of the view of the Escarpment face and skyline. For example, Mount Nemo would have a much farther-ranging specified point than the Claremont cut in Hamilton.

Easements should also be used in areas where the Escarpment is buried under soil deposits and may stretch for over a mile in width. In such places, easements should be used to keep the area as open and as natural as possible. This could be done by maintaining present land use or by allowing only the development of large estates (ten acres or more) and private recreation, such as ski slopes and golf courses.

Much stricter easements which would not allow development of any kind merit use in some areas. For example, where the Escarpment face is very prominent and beautiful, but not owned by a Conservation Authority or other government agency, easements should be used to maintain it in its natural state. Easements should also be used to preserve woodlots and streams and to maintain natural green links for hiking trails connecting the parks along the entire length of the escarpment.

Easements may be established either through payments to the landowner or through an Act of the Provincial Parliament.

DESCRIPTION OF LANDS RECOMMENDED FOR CONTROL

Grimsby to the Dundas Valley

Throughout this area, the Escarpment is very well defined as it is throughout most of the Niagara Peninsula. Almost all points along this section offer excellent views with numerous scenic ravines and waterfalls. Because of its imposing size, the Escarpment itself is a sight well worth beholding from considerable distances.

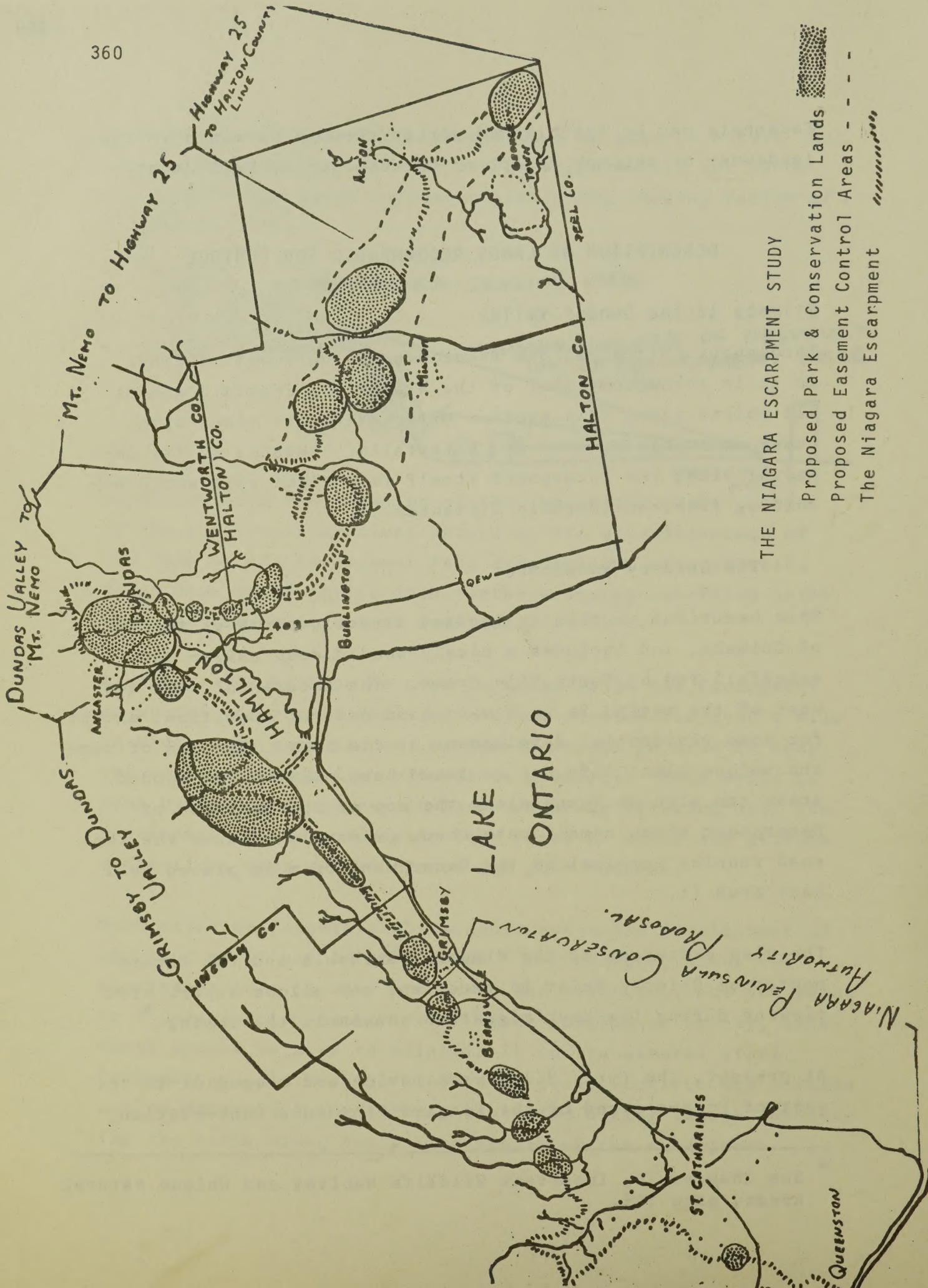
The Grimsby Escarpment

This beautiful section is located directly south of the town of Grimsby, and includes a nicely-wooded deep ravine and waterfall fed by Forty Mile Creek. The Escarpment east and west of the ravine is in a very good natural condition, except for some residential development at its foot. Species of rare and unique plant life can be found here. Extensive wooded areas can also be found along the top of this stretch of Escarpment which remain untouched, primarily because the top road running parallel to the Escarpment brim is placed well back from it.

The view eastwards of the Niagara Peninsula and the Escarpment from Grimsby Point is excellent and allows superb bird viewing during the hawk migration season in the spring.*

At present, the Forty Mile Creek ravine and a woodlot to the west of it are owned by the Niagara Peninsula Conservation

* See Chapter 10, Important Wildlife Habitat and Unique Natural Areas, page 306.



THE NIAGARA ESCARPMENT STUDY

- Proposed Park & Conservation Lands
- Proposed Easement Control Areas - - - -
- The Niagara Escarpment

Authority known as the Beamer Memorial Conservation Area. This report recommends that as much of the land as possible south of Highway 8, east of Wolverton Mountain Road, west of Mountain Road and north of Ridge Road be acquired and maintained as a passive recreation area. All the wooded areas should be left as they are now and the orchard areas to the south could be developed as picnic areas and ball fields.

Since houses do line much of the road, emphasis should be placed on acquiring the Escarpment face and wooded areas before it is sold for estate development. In addition, acquisition of the land and Forty Mile Creek south of Ridge Road above the falls would be desirable.

The view of the Escarpment eastwards from Grimsby Point should also be placed under strict easements to maintain it in its natural scenic state.

The Saltfleet Escarpment

This 3½ mile section of the Escarpment between Fifty Road and Fruitland Road is noteworthy for its excellent natural state. The main reason for its preservation is, again, that the top and bottom roads are set well back from the Escarpment face, leaving orchards and a few small woodlots to line it. This area should either be bought outright by the local Conservation Authority or put under strict easements and preserved as an example of near-virgin escarpment within close range of the large Hamilton urban area.

Devil's Punch Bowl to Upper Redhill Creek

Here is an excellent opportunity to set up an extensive all-purpose recreational park complex in the middle of an increasingly urban area. Devil's Punch Bowl, Felker's Falls, Albion

Falls, Buttermilk Falls, all the Escarpment land in between, the upper Red Hill Creek and the lower Red Hill Creek down to the Lake should all be acquired and developed for both intensive and passive recreation.

a) Devil's Punch Bowl area:

This includes all the Escarpment land above Stoney Creek, as well as the Devil's Punch Bowl, with its unusual ravine formation and view. The ravine and waterfall, along with a parcel of land immediately above it, has been acquired by the Hamilton Region Conservation Authority. The area from the Escarpment westwards to the proposed Felker's Falls recreational area should be purchased to provide a link between the two areas. Some further extension of the present Conservation Authority property, above and eastwards along the Escarpment, would also be desirable.

b) Felker's Falls Area:

This includes all the Escarpment land between Highway 20 and Mount Albion Road. This stretch of amazingly beautiful Escarpment within the City limits of Hamilton has remained in an untouched natural condition.

The area at the foot of this stretch of the Niagara Escarpment is extensively wooded as is also the area surrounding the top of Felker's Falls and ravine. To the east of the ravine and back from the Escarpment there is another fairly large wooded area. To the west of the ravine, the top of the Escarpment is primarily in orchards and the view from these sections is very good. In the area just west of Highway 20, some residential development has taken place along the crest and toe of the Escarpment and a reservoir is being built at the foot. At the west end of this area, a golf course occupies the land just below the Escarpment and east of Albion Road.

This study recommends that the Felker's Falls area be developed as a multi-use recreational area. The woodlots below and above the Escarpment should also be acquired and kept in the natural state. A large area above the Escarpment in the west half of the Felker's Falls area should also be obtained by the Conservation Authority or Ontario Department of Lands and Forests. A reforestation project would round out the present wooded areas. The parts which are now orchards and open fields could be developed as picnic areas and ball fields. The entire Felker's Falls area is now in private hands.

At this moment the Red Hill survey is quickly approaching the foot of the Felker's Falls section of the Escarpment. In fact, bulldozers are already ploughing away at the woodlots below the escarpment, and homes are planned for the wooded areas along both sides of the street. *Houses, if built on the Escarpment side of the street, will block access by the public to the Escarpment.*

Saltfleet satellite city, to house 25,000 people, is planned for the top of the Escarpment. There is a large, growing quarry above the eastern section of the Escarpment in this area. Both projects could have a detrimental effect on the park area. *These conflicts should be publicly aired and examined and a decision made which will benefit the populace most in the long run.*

It should also be noted that below the Escarpment, in the Red Hill Survey development area, several streams have been left in their natural states to connect with the Red Hill Creek. The ravines of the streams act as a green strip through the urban area. This represents a step forward in urban planning; *however, the placing of houses between the gullies and the nearest road will result in making much of the area inaccessible*

to the public, which defeats the purpose of leaving the ravines intact.

c) Albion Falls area:

This area is banded by Mount Albion Road to the east, Mud Street to the south, the Escarpment to the west and by a suburban development to the north. Most of this area (approximately 800 acres) is owned by the Hamilton Parks Board which is very detailed plans for the area. The piece of land (about 160 acres) above the Escarpment is to be an intensively-used recreational area. In the north half of the property below the Escarpment, a golf course has been created. The south end which is partially forested and includes Albion and Buttermilk Falls is being "developed" as a hiking and picnic area. Just below the junction of the Red Hill Creek (feeding Albion Falls) and its tributary (feeding Buttermilk Falls) a dam is proposed.

Although the city of Hamilton should be congratulated for acquiring this area, it is unfortunate that it has been developed as it has. This study recommends that the city continue with plans for the golf course and the area above the Escarpment, but that the area below and to the south be maintained as a wildlife and hiking area. It is recommended that no more "make-work-tree-thinning" projects be allowed in the area; that no more bulldozing and cementing in of the Red Hill Creek be allowed; that abandoned cars and other garbage found along the face of the Escarpment and ravines be cleared out; that no more sewer mains be put through the ravine area; and that an extensive reforestation project be initiated. It is also recommended that an investigation into the proposed dam be initiated to see if this really is desirable and necessary.

d) The Red Hill Creek:

This section deals with the Red Hill Creek above, the Escarpment and below the new golf course. The Creek above the Escarpment runs through primarily open farm land forming a number of ponds and small swamp areas and skirts a few woodlots and hills. It travels through the Hamilton city dump, a major source of pollution, and runs over the Escarpment at Albion Falls. Throughout, the creek area has an abundance of common plant and animal life, both aquatic and land types. Numerous species of smaller animals are found here. Deer have occasionally wandered into the area. Ducks frequently nest along sections of the creek and there is an abundance of other common bird life.

At this time, the area is zoned residential, and present plans are to lay sewers in the creek and run the Mountain Expressway over it which would be connected to the Red Hill Expressway.

This report recommends that the Red Hill Creek area east of Sherman Avenue be acquired and preserved. It should be left in a completely natural state as an ecological preserve and outdoor classroom. There are approximately a dozen schools and proposed schools either bordering the Red Hill Creek or within a fifteen-minute walk of it. There are a further dozen, approximately, present and proposed schools within a 15 to 45-minute walk.

Some of the presently bare hills could be used as toboggan and small ski slopes in winter. The city dump when closed could be landscaped into small hills and slopes with some left bare for winter sports and others reforested. In order to preserve the water flow of the Red Hill Creek and maintain it as pollution-free as possible, the new suburbs should have a separated

sewage system, connecting sanitary sewage with the treatment plant and allowing storm runoff sewers to empty into the Red Hill Creek.

The Hamilton Region Conservation Authority owns a large parcel of land south of Albion Falls, which includes a tributary of the Red Hill Creek that they plan to dam. The linked lands should connect with this area.

The Red Hill Creek below the new civic golf course has created a ravine, much of which is still in an undeveloped state, which leads to Burlington Bay. The areas above the ravine on both sides are very heavily urbanized with both residential and industrial development. The ravine would make an excellent park area and corridor connecting the proposed escarpment park system with Confederation Park.

Bicycle paths, walking trails, sled runs, picnic areas and a few natural areas as outdoor classrooms could all be accommodated in this ravine area. It is recommended that the ravine either be bought outright by the Parks Board of the City of Hamilton or the Hamilton Region Conservation Authority or put under strict easements and developed as such.

The Red Hill Expressway is proposed to run up this ravine and along the east side of King's Forest and connect with the Mountain Expressway (see Chapter 9: Transportation Report). *An investigation should be launched into both these expressways (vs. the possibilities of parkland needs) to decide which would benefit the population most in the long run.*

Radial Line Area

A major area which should be acquired is just west of Hamilton. It is a parcel of land on top of the Escarpment and already

This area is an excellent place for viewing wildlife, particularly birds. The numerous different species include various types of warbler, two of which, the golden and blue-winged warblers are reported to be hybridizing in the area south of the Radial Line. Numerous species of smaller animals also make their homes in this area. Squirrel, rabbit, chipmunk, skunk, raccoon, etc., are all common and occasionally deer will also wander into it.

The western half of this area could be developed for more intensive recreational uses; ball fields, toboggan slopes and small ski runs could be developed. The woodlots, swamp and scrub areas should be left as they are, to promote wildlife observation and preservation, and not be crossed by any roads. This area would also make an ideal outdoor classroom for schools, considering its great density and diversity of plant and animal life.

Note: The Hamilton Horticultural Society has campaigned for quite some time to have part of this area, presently in private hands, preserved. They have been dealing with all the land north of the Radial Line, and the Hamilton Region Conservation Authority has been concerned about the same parcel. However, the land south of the Radial Line should not be ignored, for this is where the warblers are reported to be hybridizing and all the swamp land in the proposed park is to be found here. As much of the land as possible between Highway 403, Upper Horning Road and Mohawk Road should be acquired by a public agency.

Final Points of Concern: Grimsby to Dundas Valley

It should first be realized that the remaining pieces of Escarpment between Grimsby and the Devil's Punch Bowl which were not dealt with in detail should not be overlooked. This

entire area is very scenic and has some excellent viewing points.

The Escarpment face should be placed under strict easements, and maintained as a link with the park systems; a scenic easement should also be placed below this area

The recommendations for the section of the Escarpment running from Grimsby to the Dundas Valley may be seen as excessive by some, particularly those dealing with the Devil's Punch Bowl to the upper Red Hill Creek section. But consider the amount of expansion which is expected to occur in the Hamilton area and the population's desire for natural areas. This desire is indicated by the existence and over-use of the Royal Botanical Gardens and King's Forest to such a degree that the ecology of these areas is presently suffering. Because of this, the recommendations in this part of the report are not excessive, but should be carefully considered.

The Dundas Valley To Mount Nemo

The Escarpment in this section turns in a horseshoe shape to form the Dundas Valley. The curve of the Escarpment is buried under glacial deposits and takes the form of extended rolling hills. Some very beautiful waterfalls and ravines are to be found on the Escarpment near the Dundas Valley.

From the Dundas Valley, the Escarpment turns northwards and takes the shape of a large steep rolling slope as far as Mount Nemo.

The Dundas Valley

The Dundas Valley, because of the great abundance of wildlife,

and the unique and rare flora and fauna in the area, *must* be preserved. It has been of great public concern for quite some time and many recommendations have been made concerning its preservation. The most popular theory is that it be developed as a major multi-purpose-recreation regional park complex; this is presently what is happening.

The Hamilton Region Conservation Authority has plans, drawn up by the Hamilton-Wentworth Planning Area Board, to acquire over 2,000 acres in the Dundas Valley (see Map 1). The Authority has already acquired considerable acreage and is optimistic that the final goal will be achieved.

The rest of the Dundas Valley should be put under easement control and maintained as either farm land, private recreational land or sparse residential estates.

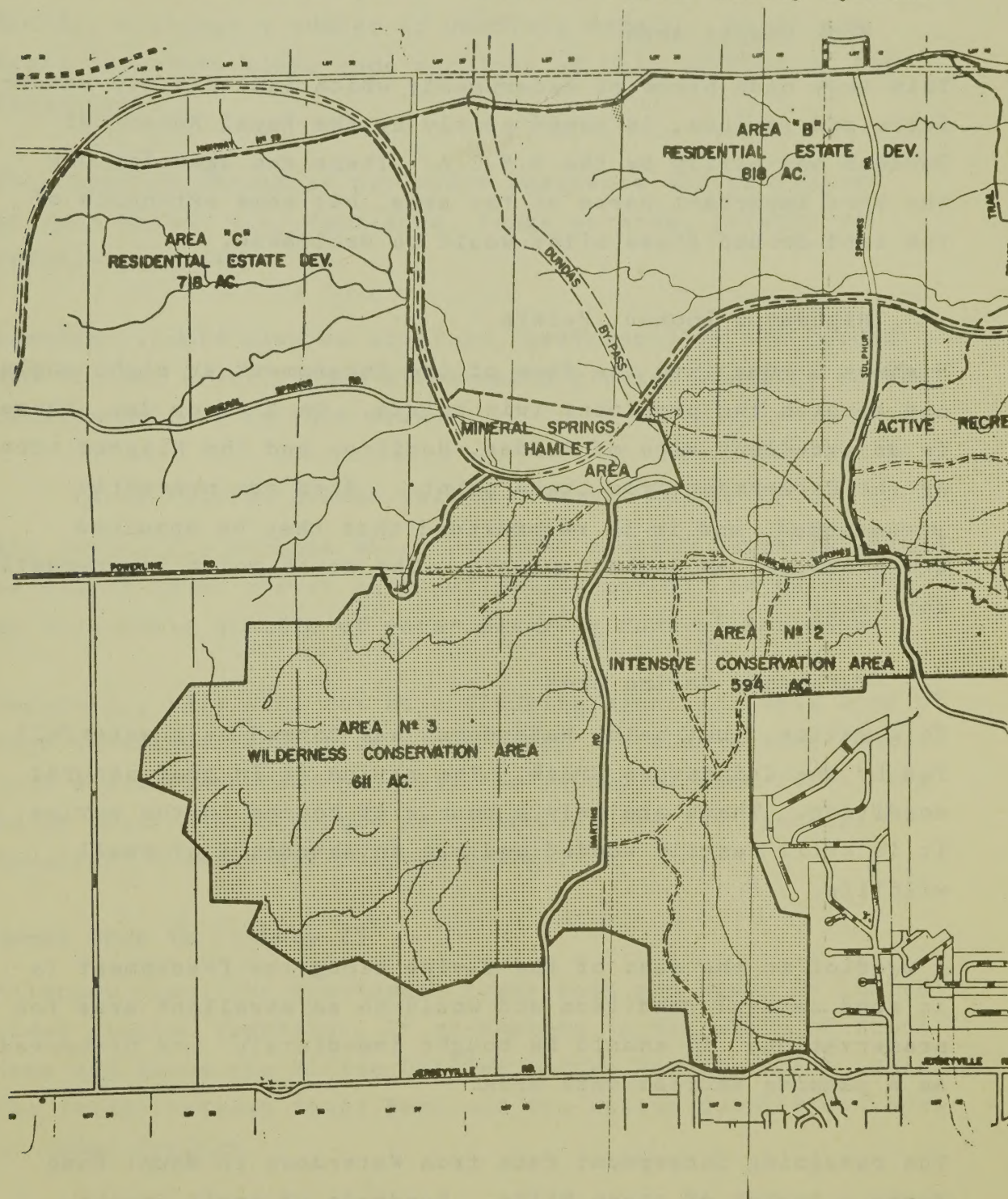
The three main creeks in this area - Spencer, Sulphur and Ancaster Creeks and their tributaries - should be carefully controlled to keep them pollution-free and to act as a flushing device for the much-polluted Cootes' Paradise. Chedoke Creek, which also runs into Cootes' Paradise, should also be cleaned up.

The proposed Dundas Valley Expressway which would connect the Mountain Expressway with Highway 8 should also be investigated, and a permanent decision made about its future; it appears to have been shelved at the present time.

Webster's Falls and Tew's Falls

These beautiful ravines and waterfalls are already owned by the Hamilton Region Conservation Authority, who have done an excellent job of maintaining and managing these areas.

MAP 1 Recommended Development Ancaster-Dundas Valley Systems*



* Hamilton-Wentworth Planning Area Board, *A Study of the Ancaster-Dundas Valley System for Conservation Purposes II: Appraisal and Recommendations* (prepared for H.R.C.A., May 1968) p. 74 (Map No. 8)

Rock Chapel Area

This very nice piece of Escarpment, which includes two waterfalls and ravines, is owned partly by the Royal Botanical Gardens and partly by the H.R.C.A. These two agencies own the most important parts of the area, but some extension of the land around these sites would be desirable.

Highway 6 Lookout Points

Highway 6 runs into the face of the Escarpment at right angles and creates two prominent twin points. On a clear day there is an excellent view of Dundas, Hamilton and the Niagara stretch of the Escarpment from these points. Both are presently undeveloped, and it is recommended that they be acquired and preserved as lookout points. The south point is presently for sale.

Waterdown Ravine Area

This ravine, just below Waterdown, was formed by a waterfall fed by the Grindstone Creek. The ravine is in good natural condition. There are only a couple of houses in the ravine; it is still heavily wooded and has an abundance of small wildlife.

A woodlot to the east of the ravine along the Escarpment is in good natural condition and would be an excellent area for preservation. It should be bought immediately and preserved as a passive recreational area.

The remaining Escarpment face from Waterdown to Mount Nemo forms a series of steep hills. Hundreds of small creeks and streams have their source in this area. Much of the Escarpment has been cleared to create orchards, pastures and crop

fields, although a number of woodlots remain. There are excellent views along some sections of this portion of the Escarpment.

This section should be put under easements and maintained as open space, i.e. farmlands, large estates, private recreational areas.

Parkland should also be acquired, preferably in the wooded and viewing areas. Such sites could provide examples of the Escarpment form in this area.

Final Points: Dundas Valley to Mount Nemo

All creeks and streams which run into Cootes' Paradise should be placed under strict anti-pollution control to maintain an acceptable quality of water entering Cootes' Paradise.

Hopefully, this will act as a flushing agent for this area of high waterfowl production capability, and thus ensure good bird populations, and possibly the return of game fish. The major creeks which should be controlled are the Spencer, Ancaster, Chedoke and Sulphur Creeks.

Mount Nemo to Highway 25

At Mount Nemo, the Escarpment turns west and again is buried under glacial deposits. It re-emerges to the north of Mount Nemo and forms the Milton Outlier before heading north again. The valley between Mount Nemo and the Milton Outlier is known as Cedar Springs.

Mount Nemo Area

This very scenic bluff, over 250 feet in height, is a familiar landmark in the Burlington area and is excellent for scenic

viewing. The Halton Region Conservation Authority has acquired the prominent bluff of Mount Nemo, but it is recommended that further lands be acquired to "round out" the area.

Cedar Springs Area

This area lies between Rattlesnake Point, Mount Nemo, and east of Progresston. The Escarpment is here buried under glacial deposits and is developed primarily as farmland and for private recreation, with ski slopes and golf courses. Bronte Creek runs through the middle of the Cedar Springs area.

The bulk of this area should be put under various types of easement control, primarily for its scenic value from Mount Nemo and Rattlesnake Point. However, easement control should also allow private recreation and ten-acre estates, and encourage the continuation of the use of this land for farming purposes.

Two areas are recommended for acquisition in the region of Cedar Springs. The first is a cedar swamp, south east of Kilbride and west of McClure Lake. Here can be found an abundance of swamp life, including a large waterfowl population. The swamp provides headwaters for a creek which joins the creek from Crawford Lake and eventually feeds into the Bronte Creek. This swamp is presently in private hands and should be acquired as soon as possible to be maintained as a waterfowl refuge.

The second is a large, heavily-forested area north of this swamp. It includes Crawford Lake and its creek. About half of this area has already been acquired by the Halton Region

Conservation Authority (including Crawford Lake and its creek), but further rounding out is recommended to connect it with the swamp area west of McClure Lake mentioned above.

The Milton Outlier Area

The Milton Outlier is a circular piece of the Escarpment separated from the main ridge by a ravine. Rattlesnake Point is on the southern tip of this Outlier, and offers some excellent views of Mount Nemo and the Cedar Springs area. The east side of the Outlier is very erect and scenic, and offers more good viewing opportunities. To the north is the Kelso Conservation Area and to the west the main Escarpment, although in places it is not very clearly defined. The top of the Milton Outlier consists of farm lands. Some scattered development is occurring on the slopes, including quarrying on the north east slope.

The Halton Region Conservation Authority owns Rattlesnake Point and the lands to the west connecting with the main Escarpment and the Crawford Lake property. Fortunately, this area also includes a large section of the ravine between the Escarpment and Outlier, which is an ecological must for preservation. The Halton Region Conservation Authority also owns a parcel of land on the north end of the Outlier known as the Kelso Conservation Area.

The Outlier face between Rattlesnake Point northeast to Kelso should be acquired to preserve the face, and to act as a link between the Rattlesnake and Kelso park properties. Quarrying operations on the face should cease. Further acquisition of the farm lands on top of the Outlier, around Rattlesnake Point, should also take place; it is recommended that it be developed as an intensive recreation area. An extension of

the ravine lands, between the Escarpment and the Outlier, is also recommended for preservation in its natural state.

The Highway 401 North Area

From the Kelso Conservation Area, the Escarpment becomes very prominent and heads due north again. Above Kelso and Highway 401, and south of Highway 25, lies the longest, most unspoiled, naturally maintained section of Escarpment in the study area. Again, this is due to the fact that no roads skirt the Escarpment here. The lands below the Escarpment are being farmed, but above it lie extensive forests. There is a large variety of wildlife in this forested area, including deer and brush wolves. There are two small quarries that scar the area, one on the Escarpment face and the other slightly back from the edge.

The Halton Region Conservation Authority owns a large parcel of the forested area just west of Kelso and Highway 401, and sections of the Escarpment face. The remaining Escarpment face between Highways 401 and 25 should be acquired, along with an extensive wooded area behind it. The area should be kept as forest and maintained as a wildlife flora and fauna reserve. The forest area continues for a considerable distance beyond the area of acquisition; it should be placed under strict easement control and as much of it as possible be maintained as forest.

Final Points

The reason why such an extensive amount of land is being recommended for acquisition in the section from Mount Nemo to Highway 25 is that this area should be developed as another major multi-purpose park, containing everything from the most passive to the most intensive forms of recreation. Gertler

made similar recommendations in his report.

Highway 25 to the Halton County Line

For the most part, the Escarpment is buried under glacial deposits in this area, except for a section near Georgetown; much of it is wooded.

Acton Escarpment Area

This refers to the Escarpment from Highway 25 to what is called in this report the Georgetown Escarpment which lies just south of the Caledon Mountain area. Glacial deposits have created extended hills in this section which are covered in forest containing an abundance of wildlife. It is recommended for easement control so that it can be kept as open space, allowing some private recreational development and estates. Parks which show good examples of the Escarpment landform are also recommended to be placed within this area.

Georgetown Escarpment

Here the Escarpment is very prominent, just south of the intersection of Halton, Peel and Wellington Counties. The Escarpment face is wooded, along with the area above it. There is an excellent view from here, and no roads skirt the escarpment face thus accounting for its good natural state. Below the very prominent section of the Georgetown Escarpment are a series of small quarries which are among the very few places where Whirlpool Sandstone deposits still exist (see page 398 of this report). So scarce is this stone, Vos⁹ recommends these reserves be carefully preserved for future use. From the point of view of conservation, areas containing this stone should be protected by non-extraction zones. The stone is of historic value, being the substance of Queen's Park, the

⁹ Vos, M.A., *Stone Resources of the Niagara Escarpment*, Industrial Mineral Report #31, Ontario Department of Mines, 1969.

Royal Ontario Museum and the old Toronto City Hall. These very limited remaining deposits should be preserved in their geological setting.

The area immediately north of this piece of Escarpment is extensively wooded with numerous creeks and small lakes. This report recommends that the prominent section of the Escarpment, the woodlot above it and the forest and lake area to the north be acquired and developed as a primarily passive multi-use recreational area, for swimming, hiking and picnicking.

Final Points

The study area ends at the Halton County line. North of this, the Escarpment is covered under deposits of glacial material known as the Caledon Hills.

FURTHER ESCARPMENT PROTECTION

It is obvious that not all development can be kept off the face of the Escarpment. Roads, expressways, railways, and hydro towers must go through, but the destruction caused should be kept to a minimum. The following are recommendations for doing so.

Expressways, Hydro Rights-of-Ways, Railroads, Etc.

General controls

The construction of roads, expressways, hydro rights-of-ways, railways and other linear developments should not be allowed to destroy any unique rock formations, wood lots, or ravines. Such man-made features should be either tunnelled,

or run *at right angles to the escarpment* (e.g. the Clappison Cut) and not parallel to the face of it (e.g. the Claremont Cut and Highway 403).

Scenic drive control

For quite some time there has been considerable discussion about a scenic drive following the Niagara Escarpment from Queenston to Tobermory. In fact this has become a reality for the Queenston to Hamilton stretch of the escarpment.

Although the idea of a Niagara Escarpment Area scenic drive has merit, extreme care must be taken in the placing of such a road. *As past evidence has shown, a road which skirts the escarpment is the quickest means of destroying it.* If a scenic drive is built, it should be placed well back from the escarpment face and make occasional loops to points of interest.

Intensive Recreation Forms

The construction of very massive and intensive recreation forms such as golf courses and ski slopes should not be located on unique sections of the escarpment or in areas of ecological importance.

Building Easements

In places where the escarpment is prominent and distinctly defined, as it is throughout most of the Niagara Peninsula, strict control is needed to restrict building construction. The Hamilton Region Conservation Authority recommends that no buildings be built within 500 feet of the crest and 200 feet of the toe of the escarpment. These distances are recommended as the absolute minimum and are to apply primarily to heavily urbanized areas. It is also recommended by Hamilton

Region Conservation Authority that wherever possible these figures be extended to the maximum feasible distance.

The Hamilton Region Conservation Authority and the Gertler report also recommend that no buildings be built on the escarpment side of the nearest roads at the crest and toe of the escarpment. This would ensure easy public access to the escarpment area.

Quarries*

The Gertler Report has an excellent section on the escarpment which this report supports in full. The Gertler Report in Chapter 6.3 entitled: "Proposals, Extractive Industry" recommends the following:

" 6.3 Proposals, Extractive Industry

The proposals concerning the location and standards of operation of extractive industries are presented in Appendix 4, Proposals for an Enactment to Regulate Surface Mining in the Niagara Escarpment Study Area. Five major policy areas are considered.

- (1) Provincial standards should be prepared and applied consistently wherever extractive activities are permitted. These standards should have regard both to minimizing friction with surrounding land uses, and taking advantage of the opportunities for the creative reshaping of the landscape after extraction is completed.
- (2) To minimize future conflicts between recreational and extractive uses of land in the Study Area, a licensing system is proposed, requiring the operator to provide a legal description of the property on which extraction will occur, and of all properties held for future extractive use.
- (3) The central concept of the proposed provincial code is the site development plan, which each new operator, and existing operators, after suitable notice, will be required to file as a condition of carrying on extractive activities. This plan will show intended uses for the site during and after extraction, and embody performance standards related to the screening of the site by means of planting and the use of overburden, the removal of earth materials, safety, depth of excavation in relation to watertable, and other similar provisions. Some illustrations of site treatment accompany this chapter.

*

Also see *Quarrying and Mining on the Niagara Escarpment*, Chapter 12, page 393.

(4) To ensure that site development plans will be carried out, in accordance with field plans, the operator would be required to post a performance bond, or to remit a similar amount to an industry controlled site development fund (if such exists). The amount of the bond for remittance would be based on tonnages of extracted material.

(5) For the regulation of extractive activities, three zones are proposed for the Study Area: an inner zone, two miles wide, centred on the Escarpment face (or a designated line where the face is under glacial debris); and two outer zones, one on each side of the inner zone, extending to the outer edge of the Study Area. Regulations for the inner zone are designed to permit the continuation of established operations, while excluding new openings. The inner zone would be extended to include the Milton and Georgetown outliers. It is suggested that specific "extractive industry" areas be designated in the outer zone. This zoning policy would provide assurance, over the long term perspective that must be assumed with regard to a unique natural asset, that the area of most intense recreational use would be relatively undisturbed, and enjoy peace and quiet. At the same time, there would be no disruption of the established operations which represent a substantial part of the total industry: 13 of 14 in limestone (including dolomite); 11 of 12 in sandstone; 12 of 23 in sand and gravel; the only clay pit; and 3 of the 5 shale pits in the Escarpment region. This policy is made tenable by the availability of substantial, and in some cases superior resources, beyond the inner zone. Documentation of mineral resources will be provided in the background report on the extractive industry.

The proposals for fitting the extractive industry into the environment of the Escarpment represent a new positive philosophy of resource use. It embodies the idea of the multiple and sequential use of valuable resources, and of the continuity of landscape formation, from the opening up of a new pit or quarry to its restoration in a new, more permanent form. There are already in this Province a number of examples that give encouragement concerning the prospects of the "site development" approach. These include the Royal Botanical Gardens located in part in a mined gravel deposit; Belfountain Conservation Area in part of a former quarry, now used for swimming; a former gravel pit near Lobo, west of London, in which there is trout fishing; the Maple Honeypot, a ski area near Maple developed in a property which was in part a gravel pit; and a number of other equally interesting transformations of extractive sites.

The foregoing proposals have been evolved in relation to the Escarpment area. Consideration should be given to their Province wide relevance in the follow-up work on this study. "

A further recommendation which would be advisable for Gertler's 2-mile inner zone of control are as follows: Quarries which are on the face of prominent escarpment land, or interfere with recreation areas, or severely disrupt a scenic view, should be phased out of existence as soon as possible and re-landscaped. Also all other quarries within the two mile protective zone should be phased out of existence as soon as alternative stone and gravel sources are found.

PROVINCIAL ACTION

Gertler's report recommended that 55,000 acres be put under complete control (acquisition) and that an additional 35,000 acres be put under selective control (easements). He recommends that 46% of the lands to be controlled be assigned a first priority rating, i.e. action needed within 4 years (1972); 42% be given a second priority rating, i.e. action taken within 6 years (1974); and 12% be given a third priority rating, i.e. action taken within 8 years (1976).

His estimation (1968) of the total cost of preserving all the lands he recommended for both selective and complete control was \$31½ million. This figure has more than doubled since then due to inflation and land speculation.

Gertler also recommended that a "Niagara Escarpment Secretariat" be established to serve as a coordinating and expediting body to carry out the recommendations of his study (See Chapter 10 of the Gertler Report).

The Provincial Government's action thus far is as follows: The actual acquiring of land is left up to the Department of Lands and Forests and the Conservation Authority. They are left on their own as to what lands they choose to buy and do not have to buy within the Escarpment area if they choose not to.

However, the Conservation Authorities are encouraged to buy land in the escarpment area through a grant of 75% of land cost from the Provincial Government (instead of the usual 50%) if they buy land within Gertler's recommended escarpment area.

Municipalities are also encouraged to set up parks in the escarpment area under the Parks Assistance Act. Any municipality which wishes to purchase park land within the general escarpment area can acquire a grant of 50% of their land costs up to \$25,000 from the Provincial Government. Municipalities will also be matched dollar for dollar for the costs of developing the park area up to a maximum of \$75,000. If the municipality already owns the land it can get a grant of up to \$100,000 towards developing it. This fact is not commonly known and only two municipalities in all of Ontario have taken advantage of it.

In early 1971 the Provincial Government set up the Niagara Escarpment Task Force. Its main job is to recommend policies for land use control and protection of the escarpment and its scenic aspects. That is to say it tries to work out acceptable ways and means of setting up easements and scenic controls recommended by the Gertler Report. It makes its recommendations to the Parks Integration Board.

The members of the Task Force are representatives from the Department of Municipal Affairs, Department of Lands and Forests, Department of Environment, Department of Mines, and the Parks Integration Board. This committee calls upon whomever they wish (primarily other government agencies) for added support and information. As of yet no easements have been set up anywhere along the escarpment area.

Last year (1970) the Department of Lands and Forests was responsible for acquiring 3,030 acres of land within the area the Gertler Report recommends for control. This brings their total to approximately 16,000 acres within the escarpment area in Ontario.

Before the Government's Escarpment Policy came into being in 1968 the total acreage of all the Conservation Authorities within the Gertler Report recommended area was 4,368 acres. Between 1968 when the Escarpment Policy was initiated and March 1971, the Conservation Authorities acquired an additional 4,475 acres, for a total of 8,843 acres within the Gertler Report area. The total recommended escarpment acreages the Conservation Authorities own within the Halton County, Wentworth County and Niagara Peninsula are as follows: (Figures as of March 1971.)

Conservation Authorities	Escarpment Acreages Acquired Prior 1968	Escarpment Acreages Acquired 1968-71	Total Escarpment Acreages as of 1971
Niagara Penin.	335	3	338 *
Hamilton Region	230	491	721
Halton Region	1,682	485	2,167

Gertler recommends that 1,130 acres be acquired and 6,700 acres put under easement control by 1972 in the Niagara Peninsula Region. He recommends acquisition of 3,550 acres of land and easement control of 2,530 acres of land in the Hamilton Conservation Region Authority area by 1972. Gertler recommends acquisition of 4,300 acres of land within the Halton Region Conservation Authority and 4,070 acres of land controlled by easements. The vast bulk of this land (all except 920 acres) is given a priority one rating (1972).

The Provincial Government's total expenditure toward Escarpment preservation since the release of the Gertler Report has been \$3,430,000 for a total of 12,892 acres of land. The government has not set a date indicating when it hopes to have escarpment preservation plans completed.

* As of July, 1972, the Niagara Region Conservation Authority has purchased an additional 61 acres.

NIAGARA ESCARPMENT ACQUISITIONS: EVALUATION OF CONSERVATION AUTHORITIES

The Niagara Peninsula Conservation Authority

The Niagara Peninsula Conservation Authority has a population of 350,000 people and covers an area of 936 square miles. The Authority has an equalized assessment rate of \$.60/capita. Approximately 40 miles of the Niagara Escarpment are found within the watershed boundaries of the N.P.C.A. The Escarpment from 50 Road to Queenston is within its jurisdiction, and some of the most scenic sections of the entire escarpment are found here. A number of beautiful waterfalls and ravines are noted in the area (such as those at Beamers and Ball's Falls) and the height of the Escarpment provides an excellent view along almost the entire stretch.

The Gertler Report recommends approximately 1130 acres for acquisition in the Niagara Peninsula area. The total land presently owned by the N.P.C.A. consists of a small area at Beamers Falls and another at Ball's Falls. There are no plans in the immediate future to acquire any further Escarpment land, mainly because of lack of funds. For the past several years the Authority has been putting the greatest percentage of its available funds into the Binbrook Reservoir program and this funding is expected to continue. There are no plans to increase the \$.60 equalized assessment until after 1972.

There is also a very distinct feeling of apathy among some of the Niagara Peninsula Conservation Authority chief employees concerning the escarpment. The feeling is that the escarpment in their area does not merit protection or preservation because it is too expensive and has already too much development on it thus it is useless.

A few years ago some energetic summer students working for the Niagara Peninsula Conservation Authority drew up detailed plans for acquisition and easement control for certain sections of the Niagara Escarpment. General and detailed maps of these plans are in the files of the Hamilton Federation of Environmental Groups. These plans appear to be rather conservative in the acreage desired for acquisition, but were at least something. Unfortunately these plans have been shelved.

Immediate action should be taken in this conservation area to initiate the Gertler Report recommendations.

Hamilton Region Conservation Authority

The Hamilton Region Conservation Authority covers the escarpment from about Highway #6 north to 50 Mile Rd. There are approximately 35 miles of escarpment within these boundaries and containing such areas as the Dundas Valley and Albion Falls area.

This conservation authority is doing an excellent job of acquiring escarpment lands. They have acquired most of the major privately owned waterfalls and ravines in their jurisdiction - Felker's Falls being the main exception - and are well along in their acquisition plans for the Dundas Valley. The Authority is optimistic that they will reach their goal to acquire more than 2,000 acres in the Dundas Valley. This is more than the total acquisition recommended by Gertler. Their plans are to develop the Dundas Valley as a major multi-purpose recreation area. The Hamilton Region Conservation Authority watershed area is 185 sq. miles with a population of over 343,000 people. The equalized assessment is \$1.80/capita.

Halton Region Conservation Authority

The Halton Region Conservation Authority has an equalized assessment rate of \$2.50 per capital from its municipalities. The Authority has been asking an annual increase of about 6% of the previous year's assessment.

The watershed of this area is 363 sq. miles, with a population of roughly 165,000 people. The watershed of the Halton Region Conservation Authority has escarpment land from the junction of Halton, Peel and Wellington Counties to Highway #6 north. This represents about 43 miles of escarpment. Within this conservation authority area is the Waterdown Ravine, Mt. Nemo, the Milton Outlier and the Georgetown Escarpment.

The method that the Halton Region Conservation Authority uses in dealing with the landowners whose land they eventually hope to own is noteworthy and is to be commended. Their friendly, informal, personal approach has proven very successful. They get to know the landowners and, over a period of years explain their desires and plans for the area. This usually avoids understandable points of conflict, which often occurs in conservation areas where the agency simply hires a real estate agent to announce to the landowner that the local Conservation Authority wants his land.

SUMMARY OF RECOMMENDATIONS

1. The entire Niagara Escarpment must be maintained as a continuous green belt across southern Ontario. It should be preserved and developed as a continuous parks system and contain all types of outdoor recreation from ecological preserves to ski slopes.
2. The escarpment should be preserved by both outright ownership of lands, by some agency involved with the

natural environment such as conservation authorities or Lands and Forests, and by the use of easements.

3. The major areas which should be developed as park areas within the Halton-Wentworth county study area are:

Grimsby Escarpment	Rock Chapel area
Saltfleet Escarpment	Highway 6 Lookout Points
Devil's Punch Bowl	Waterdown Ravine
Felkers Falls	Mount Nemo
Albion Falls	Cedar Springs
Redhill Creek	Milton Outlier
Dundas Valley	Highway 401 north area
Webster's and Tew's Falls	Georgetown Escarpment

With the exception of the Webster's and Tew's Falls area, and the Rock Chapel Area, acquisition of lands is needed in all the above listed areas.

4. The following areas should be developed as major, regional, multi-use, recreation areas:
The Devil's Punch Bowl to Redhill Creek area,
The Dundas Valley,
The Mount Nemo to Milton Outlier area.
5. Strict controls should be put on all types of development in the escarpment area. This includes expressways, scenic drives, hydro rights-of-way, railways, golf course, ski slopes, all buildings and quarries.
6. A citizens committee, or a sub-committee of the Hamilton City Council Pollution Control Committee, or a combination of both, should be set up to look into and make recommendations concerning the future of the escarpment in the Hamilton area.
7. The provincial government should indicate much greater action, guidance, and spending into preserving the escarpment. The government's primary excuse for its lack of action thus far has been that of the costs of acquiring escarpment lands.

In the 1968 Gertler Report, it was estimated that the acquisition cost for the entire Niagara Escarpment was approximately 30 million dollars (31,500,000.00). Since 1968 the government has spent just over 3 million dollars, (\$3,430,000.00) on escarpment preservation. At the same time, 23 million dollars was appropriated for the construction of

Ontario Place - which could have been built at any time.

It is interesting to note that the budget for escarpment preservation in the year 1970-71 was three-quarters of a million dollars (\$750,000.00) while the budget for the Department of Highways for the same year was over one half billion dollars (\$504,580,000.00). Last year the *total* budget for conservation purposes in Ontario was less than the annual rate of increase for the Department of Highways. From these figures it becomes obvious where escarpment preservation ranks on the government's list of priorities.

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3. Mark Cressman, Department of Lands and Forests, Richmond Hill, Ontario.
4. Ray Lowes, Founder and Secretary, Bruce Trail Association, Hamilton, Ontario.
5. Dick Moskal, Long Range Planner, Town of Burlington, Burlington, Ontario.
6. George Meyers, Naturalist, Grimsby, Ontario.
7. Norman Pearson, Geographer, Centre for Resources Development, Univ. of Guelph, Guelph, Ontario.
8. Dr. Pringel, Botanist, Royal Botanical Gardens, Hamilton Ontario.
9. Mr. Seiger, Hamilton Parks Board, Hamilton, Ontario.
10. Frank Shaw, Hamilton Region Conservation Authority.
11. Murray Stephen, Halton Region Conservation Authority.
12. Hamilton Wentworth Planning Board, Hamilton, Ontario.
13. Russ Tilt, Niagara Escarpment Task Force, Toronto, Ontario.
14. B. Vanderburg, Hamilton Region Conservation Authority, Hamilton, Ontario.
15. Mr. Jackson, Conservation Authority Branch, Parks Integration Dept., Toronto, Ontario.

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INTRODUCTION

Our study area provides most of the crushed limestone used in construction in the most heavily built-up area of Canada. Limestone is plentiful; but Wentworth-Halton's is most conveniently exposed in the Niagara Escarpment. This section will examine various aspects of this inventory feature.

GEOLOGY AND THE EXTRACTIVE INDUSTRY

The Halton-Wentworth region has no deposits of metals or gems of commercial value. However, since the study area is in a process of rapid urbanization, aggregate materials useful in the construction industry take on considerable value. According to Hewitt, "aggregate" refers to "essential mineral raw materials for construction"¹ -- that is, sand gravel, crushed stone, clay, shale, gypsum and stone for cement and lime.

This industry merits special consideration not only because of its considerable present volume in the study area, but because of its tremendous predicted growth rate. According to Hewitt, use of aggregate increases not only with population, but even on a per capita basis.²

	Toronto-Hamilton- Niagara population	Total Aggregate	Per Capita Aggregate (Tons)
1950	2,000,000	7,082,788	3.5
1968	3,744,000	49,000,000	13.5
1980 ^a	5,000,000	90,000,000	18.0

This is critical for our study area because extraction has an important local characteristic: almost all operators remove aggregate from a single geological formation. While no

¹ D.F. Hewitt, *Urbanization and Rehabilitation of Pits and Quarries* Industrial Mineral Report 34, 1970, Queen's Printer Toronto, p. 1.

² *Ibid.*, p. 1.

statistics can be up-to-date in an industry which changes operation sites frequently, it would appear that of 45 extractive operations in our study area, 36 operate on the Niagara Escarpment.¹ That is the number licensed by the Provincial Government in September, 1970 under the "Act to Protect the Niagara Escarpment."

What is the effect of these operations on the Escarpment? Before the Niagara Escarpment Protection Act came into effect forbidding quarrying within 300 feet of the scarp edge the Department of Mines made these estimates of the Escarpment's durability:

Assuming that of the available acreage between Waterdown and Acton roughly about 30% is accessible to quarrying and suitable for the production of crushed rock, and that by 1980 about two thirds of the annually required tonnage of crushed stone or 23,000,000 tons will be produced from this area, a strip of land $\frac{1}{2}$ mile by $\frac{1}{3}$ mile by 60 feet down or over 0.2% of the total available resources, will soon be quarried annually.²

If we subtract the 300 feet, of course, we may assume that quarrying will not go on quite so long. Nonetheless, Vos' figures do indicate it will take 150 years to use up the available 30%. If per capita demand and overall population continues to increase as predicted, this 150 years will be shortened to a fraction of that time.

Vos (personal communication) cautioned that his figures were somewhat arbitrary and not to be considered definitive. However, there is no doubt that crushed stone use is increasing at a faster rate than any other aggregate. In our study area production has increased 500% over sixteen years

¹ Communication with Mr. G. S. Riddell, Mines Inspection Branch, Department of Mines.

² M. A. Vos, *Stone Resources of the Niagara Escarpment*, Industrial Mineral Report 31, 1969, Queen's Printer, Toronto, p. 5.

(1950-1966) -- twice as fast as sand and gravel production and over five times faster than population.¹

Escarpment Profile: Geological and Economic

The Escarpment is an erosional feature. It occurs because a layer of soft Ordovician shale is overlain by resistant Silurian rock. At one time this cap rock extended farther to the northeast, but has since eroded away. Weathering of the underlying shale causes the cap rock to extend out overhead. Eventually, the cap rock breaks off in large boulders, creating the sharp edge of the Escarpment which is so constantly renewed by this breaking-off process.²

The resistant Silurian beds have a number of layers or formations. According to Middleton,

A formation is defined as a stratum or series of strata that serves as a natural unit for geological field work, because the beds have some readily recognizable feature in common (e.g. colour, grain size, rock type, etc.) that sets them off from the beds above and below.³

These beds, together with the extraction that occurs in each, have been described as follows:⁴

Queenston shale: uppermost Ordovician stratum, 2-12 miles wide, 600 feet deep at Hamilton. Used for brick and tile. Companies involved: Canadian Pressed Brick Co. (Hamilton), Hamilton Brick Ltd. (Hamilton), Diamond Clay Products Ltd. (Tansley), Milton Brick Co. Ltd. (Milton). 1967 total value:

¹ *Ibid.*, p. 4.

² Hamilton and Halton Region Conservation Authorities, *Quarrying and the Escarpment*, 1966, p. 14

³ G.V. Middleton, *Notes on the Geology of the Hamilton Area*, unpublished report, May, 1971, p. 2.

⁴ M.A. Vos, *Stone Resources of the Niagara Escarpment*, Industrial Mineral Report 31, 1969, Queen's Printer, Toronto, pp. 14-22.

\$7,803,000. Narrowness of the shale as far as Aldershot compels extraction close to the Escarpment. North of Aldershot plants may be further removed, as is Diamond Clay.

Whirlpool Sandstone: 6-28 feet thick, light grey in colour. Quarried at Lime House and Glen Williams in the study area. 1966 total value: \$447,954. This stone is so scarce that Vos recommends it be used sparingly. From a conservation point of view, areas of the Escarpment containing this stone ought to be no-extraction zones for that reason alone. The stone is of historic value, being the substance of Queen's Park, the Royal Ontario Museum and the old Toronto City Hall. Very limited remaining deposits ought to be preserved in their geological setting.

Manitoulin Formation: 4-26 feet thick and buff to bluish grey in color near Stoney Creek. Not quarried.

Cabot Head Formation: 50-120 feet thick (50 feet at Stoney Creek), a grey shale interbedded with sandstone and limestone. Not quarried.

Grimsby Formation: red shales and sandstone, 45 feet thick at Niagara Falls to 12 feet at Clappison's Corners. Not quarried.

Clinton Group: limestones and dolomites. It contains a number of thin beds, including the Thorold Sandstone (4.5-13.5 feet thick), Reynales Dolomite (8-14.5 feet thick), Irondequoit Limestone (4-10 feet thick), Rochester Formation (2.4 ft. at Clappison's Corners to 58 feet at Niagara Falls), and the DeCew Dolomite (3-12.5 feet thick). Several of these have been quarried in the past, but only the Reynales Formation is presently exposed in quarry cuts.

Albermarle Group: dolomites which form the Escarpment crest. North to Waterdown they are called Lockport Dolomite (Gasport, Goat Island and Eramosa members, all of which are quarried).

At Dundas the Lockport is 135 feet thick.

North of Waterdown the crest dolomites are called the Amabel Formation, which has a maximum thickness of 84 feet in our study area.

Glacial Profile: Geological and Economic

All sand and gravel deposits of industrial significance are glacial. According to Karrow¹ such deposits in the Hamilton-Galt area lie in three geographic regions.

1. Galt and Paris Moraines: These are outside our study area. They provide the great deposits of sand and gravel in the Grand and Speed River gravel plains.
2. Southeast of the Galt Moraine: This includes Kames, eskers and beach gravels, the latter along the shorelines of the glacial lakes Whittlesey and Warren in Wentworth County.
3. Glacial lake bars: This includes the Lake Iroquois sand bar on which Hamilton is built. These deposits are now largely worked-out or built-over.

EXTRACTION IN THE STUDY AREA PRESENT AND FUTURE

A useful introduction may be provided by a set of figures for aggregate production in this province in 1967.²

Area	Tonnage	Population	Tons per Capita
Ontario	120,496,229	6,765,000	17.8
Northern Ontario	14,809,628	632,431	23.4
Southern Ontario	105,686,601	6,132,569	17.2
Wentworth-Halton-Peel-York-Ontario Counties	39,352,749	2,888,100	13.6
Brantford-Brant Counties	3,309,502	86,528	38.2

¹ P.F. Karrow, *Pleistocene Geology of the Hamilton-Galt Area*, Geological Report #16, 1963, Queen's Printer, pp. 57-58.

² *Urbanization and Rehabilitation of Pits and Quarries*, p.3.

In the two cases where tons-per-capita are highest, in Northern Ontario and in Brantford-Brant, the reasons for the intense productivity are interesting. Northern Ontario produces a great deal of aggregate almost strictly for road-building to unite its sparsely scattered inhabitants. However, Brantford-Brant produces most of its aggregate for the Toronto-Hamilton market to accelerate urbanization along the Golden Horseshoe. In this sense, Brantford-Brant is a "donor" area (to use the description of Vos).

Production along the Horseshoe (Wentworth-Halton-Peel-York-Ontario Counties) is below the provincial average. There are several reasons for this.

- Though their tonnage equals or surpasses any other area, their high population severely cuts per capita production (not usage).
- Urbanizing areas build over many deposits. Both Toronto and Hamilton cover sand-rich lake bars.
- Nature places deposits arbitrarily. Brantford-Brant is gravel-rich; Wentworth-Halton is poor (see preceding Glacial Profile).

For cost reasons deposits close to an urban area are always intensely exploited. Thus, though Wentworth has little sand and gravel, her 1969 aggregate production of 3,042,472 tons approached that of gravel-rich Brantford-Brant's 3,309,504 tons in 1967. Wentworth managed this by its large production of crushed stone from the Escarpment.

For this reason, as sand and gravel deposits elsewhere become mined out, we can expect ever-increasing exploitation of the more reliable Escarpment stone. Vos estimates that 1966 crushed stone production of 9.5 million tons in the Toronto-Hamilton area will grow to 23 million tons by 1980.¹

¹ *Stone Resources of the Niagara Escarpment*, p. 4.

Another reason we may expect increased use of the Escarpment is that the rich gravel deposits in the Oak Ridges Moraine north of Toronto may be cut off by political pressure. A number of municipal citizens' groups (York, Uxbridge, Whitchurch, Reach) are exerting heavy pressure on Toronto to go elsewhere for its aggregate. It was largely pressure from these groups which resulted in the Pit and Quarry Control Act (August, 1971).

A telephone survey of pits and quarries north of Nelson Crushed Stone in Burlington revealed the fact that their production goes mainly to Toronto. Most extractors said "all" production goes there. In fact, such producers as Sherman Sand and Gravel, Armstrong Brothers, and others of the large concerns have processing plants located just outside of Toronto. Trucks carry the raw aggregate to them via Highway 401.

Thus, if municipal pressure reduces the available sand and gravel resources north of Toronto, even heavier exploitation of crushed stone from the Escarpment than predicted by Vos will take place.

To illustrate this more clearly, we can look at a table of production of the two main types of aggregate from the five counties involved in 1969¹

	Sand and Gravel (tons)	Stone (tons)
Wentworth	512,430	2,530,042
Halton	647,999	7,122,487
Ontario	5,717,880	---
York	7,006,037	---
Peel	7,281,851	---

¹Communication with D. F. Hewitt, Chief of the Industrial Minerals Section, Department of Mines.

When we consider the ephemeral nature of gravel pits and the semi-permanent nature of stone quarries, we can see that our study area has a problem which simply does not exist in other supply areas for the Toronto-Hamilton axis. A gravel pit is exhausted (of four listed in Burlington in 1962, only one is still operating¹), while a stone quarry continues. And our study area contains most of the stone quarries.

Canada Crushed Stone in Wentworth County produces 1,000,000 tons a year, while Nelson Crushed Stone in Halton produces 2,000,000 tons a year. Both have quarriable reserves adequate for many more years, regardless of what legislation is passed to restrict new quarry development. Both are located close to the edge of the Niagara Escarpment.

In an extensive survey of the industry in southern Ontario, Blair² discovered that sand and gravel operators had average estimated reserves of 12.5 years, while limestone quarriers estimated their average reserves at 100+ years. Similarly, Hecht³ found in a province-wide survey that gravel pits had an average age of 15 years.

The Escarpment is an irreplaceable recreational resource. The problem of conflicting land use (active extraction versus passive recreation and conservation) has been best expressed by local conservation Authorities:

...despite the widespread occurrence of suitable stone the heaviest withdrawal will undoubtedly come from areas where urban growth and transportation facilities concentrate demand. Un-

¹ D.F. Hewitt, *Urban Expansion and the Mineral Industries in the Toronto-Hamilton Area*, Industrial Mineral Report #8, Queen's Printer, Toronto, 1962, p. 6.

² A.M. Blair, *Surface Extraction of Non-metallic Minerals in Ontario Southwest of the Frontenac Axis*, Ph.D. Thesis for University of Illinois, 1965, p. 178.

³ Peter Hecht, *Gravel Pits in the Environment*, B.A. Thesis, University of Toronto, 1971, p. 42.

fortunately this demand is falling squarely on scenic areas of the Niagara Escarpment.¹

Since the preparation of this report in 1966, some beginning of protection has come in the form of legislation forbidding new openings in the Escarpment face, and prohibiting quarrying within 300 feet of its edge. Though the Niagara Escarpment Protection Act (1970) has been repealed, its terms are contained in the recent Pit and Quarry Control Act (1971). Formerly, only quarries in the mile-wide protected zone on the Escarpment required licenses from the Department of Mines. Now all extractive operations, either stone or gravel, require such licenses, and a measure of control over new operations starting up has been established.

It remains to be seen whether regulation enforcement under the new legislation will prove effective in restricting quarry development in the study area. In addition, no steps have yet been taken to shut down continuing quarry operations near the scarp edge. It ought to be pointed out that two geological objections still remain to *any quarrying* within at least one mile of the brow:

1. Such openings leave a 300 foot-thick billboard facade which does not preserve the Escarpment in any real sense. From a geological standpoint, the Escarpment in many places is seven miles wide,² and
2. Quarries disturb hydrology in a unique manner. Rainfall usually filters through the porous dolomite and makes a reservoir of the Escarpment. Springs flow from its base and maintain the fertility of farms below; but quarries trap this water and usually pump it away. The springs dry up.³

Future expansion of quarrying will likely take place in Halton rather than Wentworth County. (There are 37 extraction sites

¹ *Quarrying and the Escarpment*, p. 25.

² D.F. Hewitt, *Industrial Mineral Resources of the Hamilton Area*, Industrial Mineral Report #27, p. 15.

³ *Quarrying and the Escarpment*, p. 19.

sites in Halton at present, and only 10 in Wentworth). First, urbanization is more advanced along the Escarpment in Wentworth, with consequently higher land prices and more restrictive zoning bylaws. Second, Halton is closer to the Toronto market. Third, it has a convenient artery for truck travel in Hwy. 401, and to a lesser extent, in Hwy. 7. Each of these arteries has a cluster of about a dozen quarries located within two miles of it, with relatively untouched Escarpment in between.

This "cluster development" of quarries corresponds to Vos' criteria for locating a quarry, which specifies that economic and political considerations are more important than geological ones. First, the site is located by physical criteria (drainage, rock quality) and economic criteria (closeness to urban centers) -- of which the latter is the "more important aspect of geographic location."¹

Second, freedom of operation is circumscribed by both engineering problems (amount of overburden, and so forth) and political problems (local bylaws) -- of which the latter merit much more detailed consideration.

Land Use

Despite the large number of individual operations, the actual acreage involved is small. Many operators listed are working merely on a specific project. Colossus Corp. Ltd., for example must be licensed by the Department of Mines because of the proximity of its gravel operations to the Escarpment. However, the operation is not a pit in any true sense. It is merely levelling and grading of land for a subdivision, and the gravel is sold as an incidental.

¹ *Stone Resources of the Niagara Escarpment*, p. 5.

As well, even a large quarry holds a relatively small amount of land. Nelson Crushed Stone, the largest in our study area, has total holdings of 600 acres in two sites. In 1963, the three main extractive townships in our area had the following acreage devoted to the industry:¹

Burlington:	1,877 a.	3.82% of total acreage
Esquesing:	1,082 a.	1.55% " " "
Nassagaweya:	1,702 a.	3.70% " " "

In 1970, Esquesing's acreage had fallen to 700 a., according to its Official Plan.

Land use in Esquesing was as follows:²

	Acreage	% of Total
Open Space	350	.6
Hamlet	1850	2.9
Commercial	60	.1
Industrial	140	.2
Extractive	700	1.1
Rural	59900	95.1
	<u>63000</u>	<u>100.0</u>

We must remember, however, that Blair's figures showed the provincial average to be only .5% of land in extraction. Townships in our area have several times that amount, and several times the amount of corresponding inconveniences.

The drop-off in acreage in Esquesing may be attributable to its being named a "Commutershed" area in the Toronto-Centred Plan, and therefore a no-build-up area. The Official Plan's expressed intention of observing a four-mile wide protected zone on the Escarpment (twice that recommended in the Gertler Report) likely represents compliance with this designation.

It must be kept in mind that other sources of aggregate are

¹ *Surface Extraction of Non-metallic Minerals in Ontario South-west of the Frontenac Axis*, p. 231.

² *Official Plan for Esquesing Township*, 1971, p.12.

presently sufficient. If a shortage develops in the future, the true land-use conflict may only then appear. The Official Plan for Esquesing merely recommends a four-mile wide zone. As yet, the Escarpment has no legal protection of any sort for such a zone.

Build-up of industry, urban areas and extractive acreage will likely continue unabated throughout the rest of our study area. A list of presently-existing operations is included in the Appendix.

A SPECIFIC CASE

Considering the lifetime of many years remaining for most existing quarries, it is worth our while to see what these operations mean for people immediately affected by them. Little work has been done in this area, except by Hecht¹ and Washington.² Nothing has been done by the provincial government which has spent considerable money in locating quarriable sites and providing elaborate rock quality testing for the benefit of extractors.

Hecht surveyed operators for their report on complaints which had been made to them. He found (reply rate of 39%):

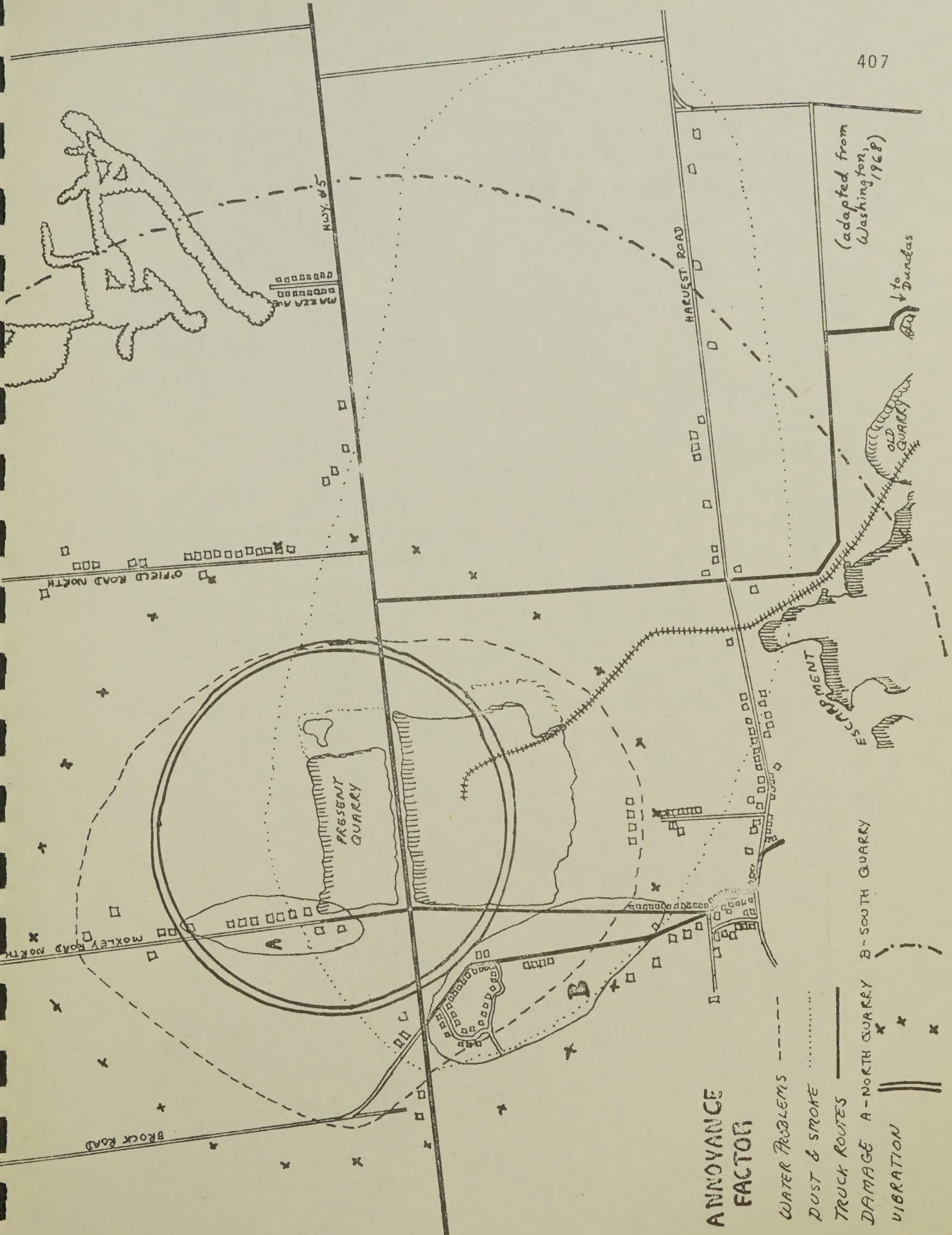
Noise: 22%	Trucks: 31%	View: 15%
Dust: 25%	Safety: 9%	Water Table: 6% ³

From Washington (see Annoyance Factor map) we discover that noise, dust, safety and water table complaints come from residents in the immediate vicinity, accounting for 62% of

¹ P. Hecht, *Gravel Pits in the Environment*, B.A. Thesis, University of Toronto, 1971.

² J. C. Washington, *A Geography of Attitudes Towards Pits and Quarries*, M.A. Thesis, McMaster University, 1968.

³ *Gravel Pits in the Environment*, p. 42.



the complaints. Truck complaints, likely from a much wider area, account for 31% of the total. View complaints could arise from anyone, including tourists, but presumably come largely from local residents who would know where to direct their complaints.

The conclusion would seem to be that most irritations concern only a small number of people. This does not justify those irritations any more than arson is excused by the small number of buildings involved.

Complaints

Let us examine Washington's study to see what one quarry has meant to local residents. The quarry concerned, Canada Crushed Stone in West Flamborough, is relatively progressive and has introduced many practices (such as informing residents of blasting times) on its own initiative. The inconveniences remaining are almost inherent, then, in any quarrying operation.

Actual complaints ranged from: noise of stripping, drilling, crushing, screening stone; dust which affected those with respiratory ailments; vibration which cracks windows, walls, crockery, disturbs children, dries up and taints wells. Washing left out when wind blows from the quarry must be re-washed. One family hides in the basement during blasting because on one occasion a rock came through the roof. After any blast, many households must clear rocks out of the yard.

Urbanization

Despite these inconveniences, between 1954 and 1967 eighty-five new homes and a senior public school were built in the map area. Seventy-five of the homes are non-farm. This is a 210% increase in housing. But, observes Washington, once

people "experience the environment...they become more aware of the disadvantages."¹

This is quite important. As he notes at another point, in evaluating pro- and con- attitudes toward quarrying, the average result is neutral in a general public sampling because most people have no experience of the operation.² An average buyer will, therefore, select a home next to one without knowing what to expect. In addition, a township can (even if accidentally) keep the quarry area populated simply by failing to approve building sites elsewhere, as was the case in West Flamborough in 1969.³

However, blasting and truck traffic can be apparent enough in the process of scouting for a home that most people shy away from purchasing near a quarry. Therefore, "Local realtors and many residents are of the opinion that the value of residential properties is depressed in the vicinity of the quarry."⁴ Such is the pressure of urbanization that the homes are saleable, but barely so.

This creates a difficult situation for analysis. The quarry is small in land area, and therefore not a major land use. Farming area remains much the same in extent. Residential dwellings appear. Commercial development fares well. Yet the environment is oppressive for residents: "It would seem that the quarry has had a much more profound effect upon the

¹ John Calvert Washington, *A Geography of Attitudes Towards Pits and Quarries*, M.A. Thesis, McMaster Univ. 1968, p. 65.

² *Ibid.*, p. 100.

³ *Ibid.*, p. 71.

⁴ *Ibid.*, p. 71.

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people of the area than it has had upon the land use."¹
Washington also notes: "The rapid growth of the population and the increased demand for the products of pits and quarries are occurring simultaneously. Thus the problem is just beginning."²

Psychological and Social Factors

The lack of a land use conflict should not allow us to discount the effect of the operation on *people*. Of the ten people opposed to the quarry, nine suffered damage to property from vibration, six had pollution and drying-up problems with their wells, and nine had tried petitions and agitation for tighter regulation of the quarry, with no success whatever. No description of psychological upsets to correspond with the physical upsets are recorded.

However, those *most in favour* of the quarry present interesting psychological situations. In particular, there was one young woman "who has grown up in this environment and hence knows no other. Her neighbor across the street complains bitterly about noise, dust and truck traffic that this young woman neither hears nor sees."³ Such a quiet person is much more a danger sign than one who is angrily aware of a conflict between normal and polluted environments.

Others in the group least opposed either benefited financially (quarry truckdrivers, a farmer who sold his land to the operator), or thought they had (those who believed revenue from the quarry kept their own taxes down).

In considering this last point, we note that the quarry and

¹ A *Geography of Attitudes Towards Pits and Quarries*, p. 75.

² *Ibid.*, p. 100.

³ *Ibid.*, p. 79.

its ancillary asphalt and flux stone plants yielded \$43,438.81 in tax revenue to West Flamborough in 1967; they were the largest revenue producer in the township. \$43,000 could not be expected to go far in road upkeep, largely necessitated by gravel truck traffic. The town of Claremont, north of Toronto, provides dramatic illustration of this: it is constructing a \$1.5 million bypass solely due to dangerous and destructive gravel truck traffic. Operators are paying none of the bypass cost. Finally, if the realtors' opinion on land values quoted above is correct, there is money lost on assessment. How much tax is lost on the home mentioned by Washington which had commanded \$25,000 before the quarry appeared next door, and which could not be sold for \$10,000 later on?

Not only such misunderstandings as those involved in finance are responsible for people tolerating extractive operations. Class distinctions must also be considered. Washington found "individuals in the lower socio-economic class were much more tolerant of noise, dust and traffic produced by the mining operations" of Canada Crushed Stone.¹ Similarly, in his section on the Brampton buried esker area, he found working class people on one side of the pits saying they were "used to it" while upper middle class people on the other side were strongly opposed because they came to the country in a "deliberate attempt to find peace and quiet."²

The existence of a whole class of people who are "used to" dirt and noise, somewhat like the young woman mentioned above, means a whole class of people who cannot function on the level of quiet and repose. They are cheated, but since it has always been so are completely unaware of the injustice.

¹ *A Geography of Attitudes Towards Pits and Quarries*, p. 101.

² *Ibid.*, p. 53.

POLITICAL ASPECTS OF QUARRYING

In his section on the history of the industry, Blair¹ has documented its increasing tendency toward centralization. He found that in 1907 the government had information on 278 extractors and brick plants. These were already clustering around urban centers, though they were still mainly small operations incidental to farming. Eleven of the twelve plants in Wentworth County in 1907 were located within the then-city limits of Hamilton.

Clay and crushed stone concerns have long since amalgamated into large, efficient corporations. Sand and Gravel, however, is characterized as still being at the stage of development exhibited by the clay industry in 1929, with large firms only recently becoming involved in it.²

In some parts of Ontario tax structures still reflect the days of farm lot extraction by zoning and taxing sites as agricultural land. In our study area, however, mineral extraction zoning (M1, M2 zones, etc.) is beginning to be introduced. It is to be hoped that areas without such zoning will hasten to introduce it. Some taxation figures follow (all for 1970):³

Burlington -	Acreage	Property Tax	Business Tax
Coronation Land Development	145	\$ 1845.79	\$ 144.49
Springbank Sand and Gravel	98	2542.84	1252.18
John Trenwith	94.6	1550.06	---
King Paving (Nelson Crushed Stone)	500	15924.88	7699.43
King Paving	104	1382.00	458.86
Diamond Clay Products	98	17879.70	10419.92
Amy and John Trenwith	49	777.00	281.75

¹ *Surface Extraction of Non-metallic Minerals*, p. 55.

² *Surface Extraction of Non-metallic Minerals*, p. 72.

³ Communication with Mrs. C. Bouskill, Clerk of Esquesing Township, Aug. 5/71, and the Burlington Planning Dept. Aug. 1/71.

Esquensing	Acreage	Total Tax
Milton Brick	108	\$ 12,741.53
Dufferin Materials	263.8	13,313.07
Rice and McHarg Quarries	17.4	99.51
Indusmin Quarries	793	21,137.00

It does not seem that extractors pay their way in terms of taxes (refer above). This cannot be stated definitely since it is difficult to determine a) how much real estate values drop near a quarry, or b) what proportion of road damage is caused by aggregate trucks. As one Halton township clerk expressed it, there is a "lack of qualified assessment records with respect to assessment loss from depreciation and relative transportation costs versus expenditures for local traffic."¹

The "Act for the Regulation of Pits and Quarries" vests regulatory power with the Department of Mines which has in the past shown itself extremely partial to the industry. For example, in *Stone Resources of the Niagara Escarpment*, the author has paid lip service to the environment: "Given proper safeguards against noise and air pollution, a quarry or pit can be operated in a built-up area."² He failed to specify the safeguards, but was more specific about economic safeguards for the extractor:

A factor frequently contributing to the competitive position of operators at greater distance from the market is the freedom of operation...Freedom to choose the time of blasting is essential for efficient operation... 3

This freedom most frequently results in blasting till 1 a.m., and will continue to do so as long as competition regulates operations. What has become of the "proper safeguards against

¹ Communication with Mr. C. Thompson, Clerk-Administrator of Nassagaweya Twp., July 19, 1971.

² *Stone Resources of the Niagara Escarpment*, p. 10.

³ *Ibid.*, p. 10.

noise and air pollution"?

Recent public pressure to regulate the industry led the Department of Mines to form a ten-man Mineral Resources Committee -- of which four members were from the industry itself. Others included three Mines engineering and geological personnel, a D.H.O. engineer, and a planner from the Treasury and Economics Department. Municipal input was in the form of a single Municipal Affairs Department planner; *no municipal representatives, conservationists or citizens who have lived near quarries were included.* Not surprisingly then, the *Report of the Mineral Resources Committee to the Minister of Mines*, in its own words, "based its deliberations on the premise that maximum utilization of available resources is desirable in view of their eventual depletion."¹ After setting up an elaborate set of regulations, the Report specified that the District Engineer of Mines could suspend all of them, with the exception of the cent-per-ton rehabilitation levy, if the company applied in writing.²

The Committee worked on cost-distance assumptions based on truck transportation, and did not consider what must be the saner methods of rail and barge transport for such bulky materials. The *Association of Mayors and Reeves Brief* criticized the M.R.C.'s "total omission of views concerning the feasibility of transporting sand, gravel, or stone by boat from new quarry and pit operations in the remote parts of the province."³

¹ J.O. Spender et al, *Report of the Mineral Resources Committee to the Minister of Mines*, 1969, Queen's Printer, Toronto, p.10.

² *Ibid.*, pp. 39-40.

³ The committee representing the Association of Ontario Mayors and Reeves, the Ontario Municipal Ass'n, the Ass'n of Counties and Regions of Ontario, the Ontario Ass'n of Rural Municipalities, *Presentation to the Hon. Allan Lawrence on the Report of the Mineral Resources Committee*, May, 1970, p. 2.

Like most levels of government, the Department of Mines feels that it has no control over the growth patterns of a free-enterprise economy. It merely observes that "...the increasing consumption of aggregates has been outpacing the population increase...This is in part explained by a change in the pattern of urban living: twelve lane expressways replace two lane roads..."¹

To spend money and effort expediting this "change in pattern" is referred to as responding to the wishes of people. This assumes that people deliberately decide that they wish twelve-lane expressways and multi-acre parking lots. The truth is much more likely the reverse: that government and industry work together to provide the framework and physical apparatus, and the consumer has no choice but to arrange his life to suit. In the presence of freeways and absence of subways he will likely buy a car.

Many agencies of the provincial government indirectly admit this. Smaller government bodies, such as municipal governments, are considered incapable of understanding the workings of the extractive industry. The Department of Mines claims it has "geologists, engineers and field inspectors" who provide information "which most municipalities could not be expected to provide."² How much less capable, then, is the man in the street of understanding these operations. The average man is most likely not aware of the rapidly-depleting state of sand and gravel reserves, or the increasing extent to which land-forms such as the Niagara Escarpment will be ravaged in providing alternate supply. An educated public might be more skeptical of the expansion syndrome which underlies these policies.

¹ *Urbanization and Rehabilitation of Pits and Quarries*, p.2.

² J.O. Spender, et al, *Supplement to the Report of the Mineral Resources Committee to the Minister of Mines*, p.3.

An Act To Regulate Pits and Quarries and to Provide for Their Rehabilitation (Bill 120, July 28, 1971)

In the light of the foregoing, certain terms of this Act must be seen as deficient. This does not overlook the fact that the legislation is a great improvement over the preceding situation. It will demand a security bond for post-operation rehabilitation; and it will demand a pre-operation Site Plan to ensure that rehabilitation will be possible. In this it reflects the best recommendations of the "M.R.C. Report".

However, it also contains the less desirable recommendations of that report. Central to these is over-reliance on regulatory power. A case may be made for statutory powers, of which the public can be certain and which may be carefully scrutinized at the time of the Bill's passing.

Regulations are also unsatisfactory because the administrative duty has been left to the Department of Mines, which has certain built-in shortcomings for this task. The Mines Minister may now determine:

1. that quarries producing less than 10,000 cu. yds. *per annum* may have a "short form" site plan which he designs. Since most extractive operations are intermittent (depending on the market), most have at least one year in which production is less than 10,000 yards. Are all of these exempt from the site plan specified in the Act?
2. whether an applicant for a new site gets a license. No public hearing of neighbors to be affected need be called.
3. How large the security bond is to be. This, the only guarantee of any money for rehabilitation, was set at a cent-per-ton by the "M.R.C. Report". It is unclear how much rehabilitation could be accomplished by such a sum.

Of major significance is the government's power to make exceptions:

"The Minister may, where in his opinion to do so would not be against the public interest, in writing relieve a license or permittee from strict compliance with any provision of the regulations..."¹ Again, no public hearings of any sort are specified.

A major source of concern to municipalities in this matter was whether the Department of Mines would gain the right to decide where extraction might go on. It was felt that the relatively small number of people suffering intolerably from the industry could only make their voices heard at a municipal level; they would be lost at the provincial plateau.

The Act seems to recognize this, and provides that no licence may be granted by the Minister where local bylaws forbid the establishment of new operations.

Many municipalities in our study area have taken first steps in this direction, and it seems fortunate that their right to "self defence" has been upheld. A list of bylaws in this regard will be contained in the Appendix.

REHABILITATION OF EXTRACTIVE SITES

...implied in the words reclamation, restoration, and rehabilitation...is a change toward a "better" condition. The use of these words, therefore, stigmatizes and degrades the extraction process...and does not allow for full recognition of the fact that every facet of the cultural landscape is in a state of change...²

¹ *An Act to regulate Pits and Quarries and to provide for their Rehabilitation.*

² *Surface Extraction of Non-metallic Minerals*, p. 129.

Blair concurs with the Department of Mines that aggregate must be extracted as part of an inevitable "development" process. He points out that "rehabilitation" implies a return to the former condition, which he maintains makes no sense if it means filling in quarries or trying to restore natural contours.

To take his reasoning one step further, we may quote Dr. A. G. McLellan of the University of Waterloo, who has pointed out:

The many "morainic areas of rolling hill lands in southern Ontario, frequently offering the few remaining scenic views, "wild" treed landscapes and non-cultivated areas available as havens for wildlife and for pedestrian "breathing spaces", all contain sand and gravel--how can these be replaced? Rehabilitation cannot do it, a magician's wand might.¹

Pits and quarries can be rehabilitated only to further states in the urbanizing process. Apartments and houses may be built in them; well-trimmed parks may be included (always with the tell-tale "shallow bowl" effect of Christie Pits in Toronto); but they may never be returned to a "natural" state. They may never satisfy the intangible needs to which the "wild" areas reply.

In addition, unique geological formations may be forever destroyed. The Niagara Escarpment is only the most obvious of these; other areas, such as esker deposits, may be totally mined out. Such formations are often rare (our study area has only one extensive esker) and are potentially useful in other connections mentioned in the geological report.

Once these limitations are understood, we can begin to appreciate the positive elements in rehabilitation. The Department

¹ *Globe and Mail*, March, 1970.

of Mines *Guide to Site Development and Rehabilitation of Pits and Quarries*¹ is a useful and complete technical guide showing possible site plans, methods of progressive rehabilitation (where a pit is graded and planted even while the next section is being excavated), types of grass, shrubs and trees appropriate to rehabilitated areas.

We will not provide a summary of this material, which is available from the Department of Mines Bookstore. However, a brief critique of the material is in order, which we might place under the headings Variety, Time, Cost Factor.

Variety

Bauer restricts his list of trees, shrubs and grasses to those "hardy" enough to take hold in a quarry area. The full spectrum of natural vegetation present before quarrying will not be replaced. In addition, this task might prove impossible if undertaken. The laws by which a community of flora and fauna establish themselves are not fully known; it is known that a mature forest takes much longer to develop than the mere age of the trees--which may be several hundreds years in itself. More immediately, we also know that piles of overburden sitting for years before being re-spread can be leached or, in many cases, "the centre part of the pile loses its natural humus."² In addition, topsoil and subsoil may be indiscriminately mixed in stripping, thus crippling the usefulness of the soil later on. Where Bauer says the operator ought to seriously consider separating them³ we would state that he ought to be so compelled.

¹ Anthony M. Bauer, *A Guide to Site Development and Rehabilitation of Pits and Quarries*, Industrial Mineral Report 33, 1970, Queen's Printer, Toronto.

² Appendix III to *Quarrying and the Escarpment*, p. 3.

³ *A Guide to Site Development*, p. 17.

Time

In the case of screens to cover up the vegetation, the flora must be fast-growing. Even after the operation is complete, all growth ideally would mature very fast to restore the area to "naturalness". In this process, of course, we have a further limitation of types of vegetation. Coniferous trees, which have the advantage of covering the desolation during all four seasons, tend to be over-used. This jars the eye in a landscape which has few natural coniferous areas (see Forestry section). In addition, for maximum cover, tree screens tend to be planted in straight lines, creating a utilitarian, "man-made" appearance as did the quarry itself.

Cost Factor

Plants that require minimum maintenance afterwards will tend to be planted; this further reduces specie diversity.

Due to these conditions, we concur with McLellan that extraction is the beginning of a cycle which removes permanently the initial character of the land.

We must also keep in mind that in our study area we are speaking primarily of quarries in an escarpment formation.

It is unlikely that gravel development in the escarpment area will ever approach the tonnage for stone production. Considering rehabilitation, exhausted gravel areas are easier to recover than defunct quarry areas.¹

While it is true that some quarries could be forwarded to recreational use as small lakes or "swimming holes" when and if the Escarpment is made into a park belt, we must realize that a limited number could be so used. Probably the present number is more than adequate, especially since they are located near urban areas that would desire such developed park

¹ *Quarrying and the Escarpment*, p. 26.

land.

Areas of the Escarpment to remain in their natural state should not be quarried in any way whatsoever. Such quarries cannot be re-integrated into a "wilderness" environment.

ALTERNATIVES

Reduction of Usage

The best alternative to the present problem of resource depletion and transportation conflicts is a reduction of usage.

The problem of per/capita increase in use must be remedied. This is strictly an economic-cultural phenomenon. People may live in comfort without the twelve-lane expressways to which Dr. Hewitt¹ attributes so much of the increase in aggregate use. The public is simply unaware of the resource-depletion consequences of their standard of living. This problem, of course, is quite general.

The Ontario Government has, however, established a Department of the Environment which could help to break down the cultural taboo against people seeing the connection between affluence and environment. No private agency in a free-enterprise society can undertake this task, which basically means a cutback in consumption. A public agency may. Such an agency, of course, would publicize this aspect as it involved other public agencies; for example, the exploitation consequences of the resource-mapping program undertaken by the Department of Mines. This leads to our first general recommendation:

¹ *Urbanization and Rehabilitation of Pits and Quarries*, p.2.

1. *THAT THE DEPARTMENT OF THE ENVIRONMENT PUBLICIZE THE RESOURCE- DEPLETION CONSEQUENCES OF PROGRAMS UNDERTAKEN BY ALL AGENCIES.*

Recycling

Several suggestions have come forward for the use of various industrial byproducts in lieu of stone. It has been suggested (see Recommendations section, p.425) that steelmaking slag might be profitably used as a bulk agent rather than sand and gravel. This would not only preserve primary stone resources, but recycle a tremendous volume of waste material.

Similarly, it has been suggested that bunker oil could be used as a binding agent in asphalt and eliminate much solid aggregate. This suggestion is unattractive if it means more oil extraction and refining, a far dirtier operation than any involved in stone extraction.

However, research in this direction should be supported:

2. *THAT ALL POSSIBLE SUBSTITUTES FOR STONE AND GRAVEL BE INVESTIGATED TO SEE IF THEY MEAN A) LESS PROCESSING AND POLLUTION B) LESS DEPLETION OF PRIMARY RESOURCES.*

Alternate Transportation

It is difficult to understand why bulk-capable systems like rail and boat are not used instead of truck. Nelson Crushed Stone in Burlington sends out 585 trucks daily, each carrying an average 15 tons.¹ Special trucks carry up to 60 tons. None compares favourable with unit trains, which might carry 6000 tons in 60 cars of 100 tons capacity apiece.

Only 10% of the trucks in question are owned by Nelson. The other 530 are owned by private carriers, small enough that they

¹ Communication with B. Drury, Public Relations Dept. of Nelson Crushed Stone, August 26, 1971.

presumably could not switch to the maximum size trucks. These numerous companies, moreover, would constitute a block to alternate transport methods which would make their capital investment largely useless.

However, rail transport still sometimes competes with truck. London, Ontario finds most of its aggregate within city limits, but still brings some from a distance by rail. "The one out-lying area of supply reflects the competitive nature of train-load rates with truck transport rates..."¹ (see Sources of Aggregate map).

According to a set of hypothetical rail rates constructed by CP Rail for Muirhead Engineering (Agincourt), unit trains used specifically for aggregate could reduce rates ever more. Mr. G.R. Mackie, CP's Market Development Manager, constructed a set of potential rates from an extraction point at Medonte, 150 miles north of Toronto.²

This location undercuts the assumption that extraction must be near urban areas, with corresponding population density problems. To some extent, it eliminates trucking problems.

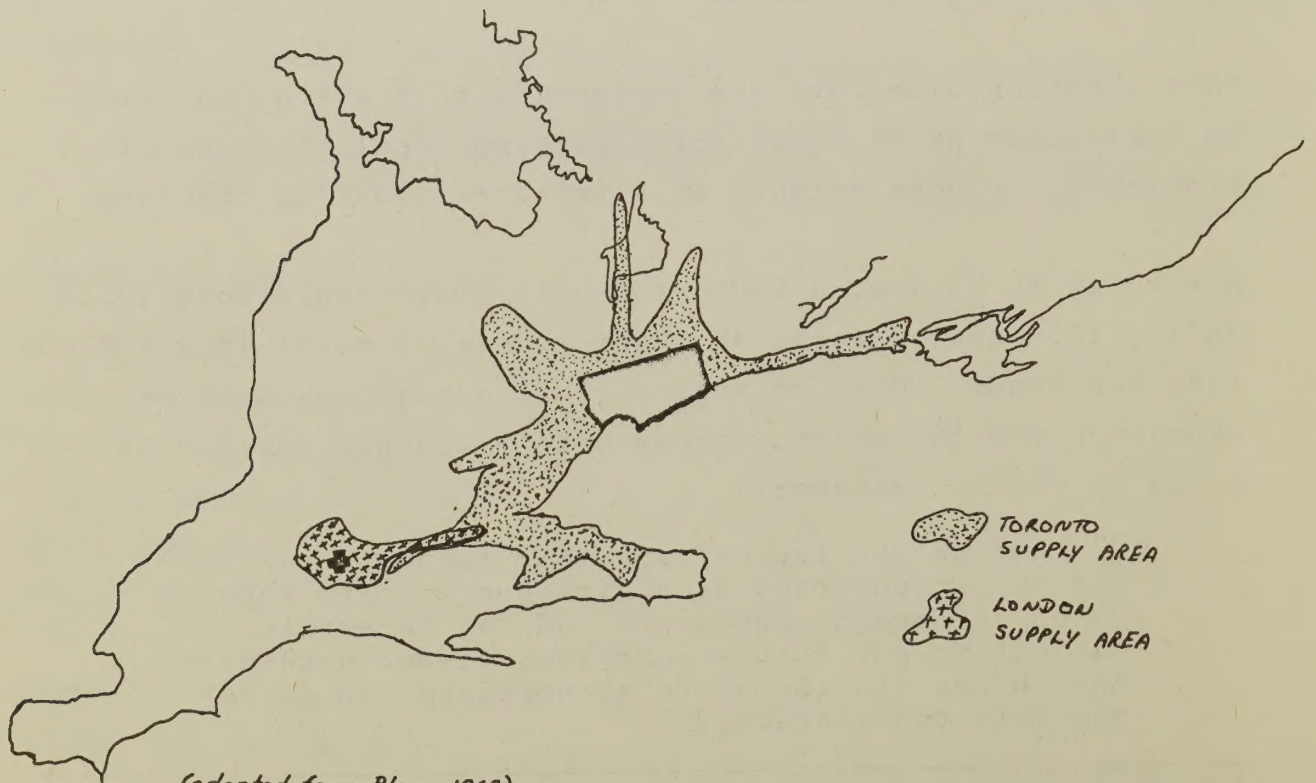
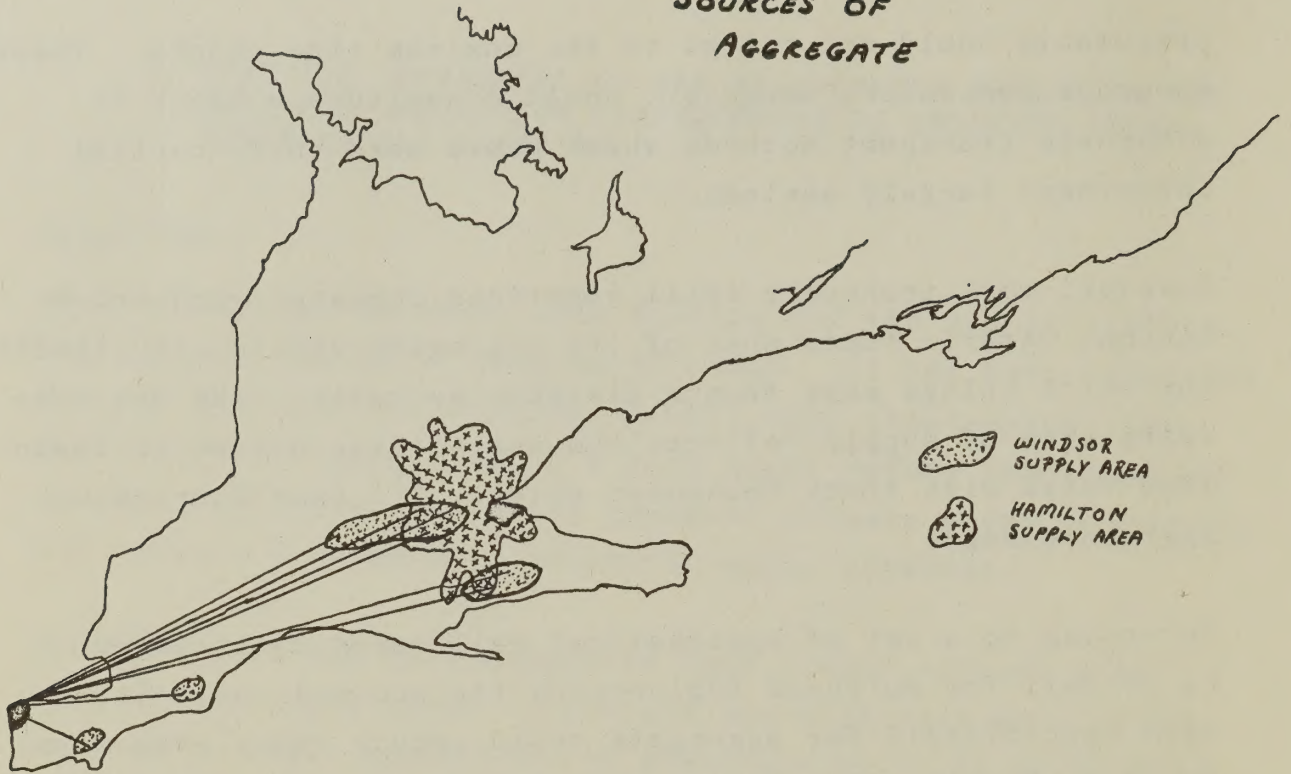
According to Mackie, a 6,000-ton unit train would move twice daily, five days a week, 44 weeks a year--a total of 2,640,000 tons per annum. Minimum transportation cost would be 68 cents/ton for 150 miles, compared to \$1.50 per ton for 35 miles by truck. However,

... due to the lack of specific factors, this is not to be construed as a firm quote. The rate is based on present-day costs and is, therefore, subject to any future increases deemed necessary. Any changes in the above assumptions can affect the rate considerably.

¹ *Surface Extraction of Non-metallic Minerals*, p. 109.

² Letter to Clark Muirhead, February 10, 1971.

SOURCES OF AGGREGATE



(adapted from Blair, 1963)

The rate might go slightly over a dollar for 150 miles, still considerably lower than any truck rate.

The trucking problem is only partially alleviated because the material would still go from the depot to the job site by that method. The distance involved in a city like Hamilton would usually be less than eight miles, which compares favorably with the usual distance of 30+ miles.

Hamilton is also well endowed with industrial rails which could make a near-downtown depot possible, and disturb residential areas as little as possible.

3. THAT INVESTIGATION OF RAIL TRANSPORT POSSIBILITIES TAKE PLACE WITH A VIEW TO THE USE OF EXISTING FACILITIES IN THE CITY OF HAMILTON.

RECOMMENDATIONS

The preceding recommendations, all of a general nature, are drawn strictly from environmental considerations. But recommendations, properly speaking, can refer to any aspect of a situation. It is felt that in the case of the extraction industry the general hypothetical recommendations were best set off as "Alternatives", while specific recommendations could be listed briefly and factually. This is the intent of this section.

From the situation peculiar to our study area, four recommendations:

1. That Whirlpool Sandstone no longer be quarried in any manner whatsoever. The scarcity of this stone has been commented upon.
2. That Escarpment quarries be compelled to recycle water into the stone rather than pump it off and

dry up springs in the base talus.

3. That townships without specific Mineral Extraction Zones hasten to introduce them along with tax rates commensurate with the industry's true cost.
4. That qualified assessment records be kept of real estate value changes due to quarrying, and of the relative cost of upkeep of truck routes versus other roads.

In addition to these specific matters, general housekeeping measures are in order. The following is a compilation of recommendations made by official bodies, legislators and academics with regard to the industry.

From the *Reach Association Brief* to the Minister of Mines (November 1970):

1. Townships must grant a lowering of tax assessment to homes near quarries based on real real estate value.
2. Trucks must be properly covered to prevent particle discharge which damages roads and people.
3. Restrict trucks to hard-surface or dust-free roads.
4. Restrict trucks to roads where speed limit is strictly enforced.
5. Operators seeking any exemptions from regulations must go before a public hearing, not merely before a mines inspector or engineer.
6. There should be a ceiling on extraction acreage in a township.
7. Freeze operations at present level: give no new licenses.
8. All governments should buy aggregate only from regulated pits.
9. A comprehensive study of extraction's effect on water table, soil erosion, wildlife destruction, to be undertaken by the province.
10. Investigate means of bulk shipment from more remote areas.

From the *York County Presentation* to the Minister of Mines
(January, 1970):

1. If, as the M.R.C. recommends, there should be "resource extraction areas" in each municipality, then the municipality must determine it. Based on solely geological criteria, Uxbridge Twp. would be two thirds a mineral extraction area. If the Department of Mines determines the extraction area, then "the power to enact zoning bylaws prohibiting the establishment of pits in areas outside the designated resource area is of questionable value."

From Blair, *Surface Extraction of Non-metallic Minerals in Ontario Southwest of the Frontenac Axis*:

1. That all extraction sites should be operator-owned, not leased. "Ownership has...direct implications with regard to reclamation of a worked-out site. If the operator owns the site, he should be more prone to work it in such a way that when the deposit is depleted the site can be transferred to another use with a minimum of effort and expense..."¹ Long-term sites, such as limestone quarries, tend to be 100% operator-owned. Short-term ones, such as gravel pits, were only 58.6% operator-owned.

From *Hansard*, during the debate of the Pits and Quarries Control Act, 1971:

1. All power over extraction should be statutory, not regulatory.
2. No pit or quarry should operate between 6 p.m. and 6 a.m.
3. Residents should be notified of blasting times.
4. Bill should specify
 - a) that topsoil from site be used in rehabilitation;
 - b) that already-abandoned pits be reclaimed;
 - c) that Crown lands not be used for extraction.
5. Northern areas should not be exempt: bill should regulate all areas of the province.

¹ *Surface Extraction of Non-metallic Minerals*, p. 95.

6. O.W.R.C. should conduct detailed well readings near a new pit before and during its operations.

Some of these proposals may appear in the Regulations for the Act.

APPENDIX I

LOCATION OF PITS AND QUARRIES BY LOT, CONCESSION AND TOWNSHIP

A) Permits under Bill 79 for Halton and Wentworth Counties

1. Armstrong Holdings (Brampton) Ltd., Easton's Pit E1/2 23,
Concession 10, Esquesing Township
2. Armstrong Holdings (Brampton) Ltd., Vinemount Quarry,
P. Lot 5, Concession 5, Saltfleet Twp.
3. Barnes, Wm. R. Company Ltd., Waterdown; Lot 19, Concession 5
Esquesing Township
Lot 21, Concession 5,
Esquesing Township.
4. Bishop, C.G., R.R. 5, Georgetown, Pt. lot 23, Con. 10W,
Esquesing Township
5. Campbellville Gravel Supply Limited; Area B- Lot 6, Con. 4,
Nassagaweya Township
Area A- Lot 5, Con. 5,
Nassagaweya Township
6. Campbell, H.D., Georgetown, W1/2 Lot 23, Concession 9,
Esquesing Township
7. Canada Crushed Stone, Div. of Steetley Industries, Hamilton;
Pt. Lots 8, 10, 11, Con. 2, W. Flamborough Twp.
Pt. Lots 9, 10, 11, 12, Cons. 3, W. Flamborough Twp.
8. Century Quarries Ltd., Clarkson, Lot 22, Con. 5, Esquesing Twp.
9. Colossus Div. Corp. Ltd., Georgetown E1/2 Lots 26, 27,
Con. 7, Esquesing Twp.
10. Consolidated S. & G. Ltd., Toronto 19, Pt. Lot 32, Con. 11,
Esquesing Twp.
11. Cope, A.E. & Sons Ltd., Hamilton, Lots 25, 26, 27, 28, Con. 6,
Saltfleet Township
12. Corner's Sandstone Quarries (1966) Limited, Erin
Quarry 2, E1/2 Lot 28, Con. 10, Esquesing Twp.
Quarry 1, W1/2 Lot 27, Con. 10, Esquesing Twp.
13. Coverdale, Donald, R.R. 3, Campbellville, Lot 2, Con. 8,
E. Flamborough Township
14. Duff, J.D. Ltd., Rexdale, Pt. Lot 23, Con. 5, Esquesing Twp.

15. Dufferin Materials & Const. Ltd., Toronto, Lot 10 Pt. 8, 9,
Con. 1, Esquesing Twp.
16. Franceschini Bros. Const. Ltd., Cooksville, N.E1/2 Lot 11,
Con. 4, Town of Burlington
17. Garvin & Logan Quarry, Glen Williams, Pt. E1/2 Lot 29,
Con. 10, Esquesing Twp.
18. George, David Lloyd & Company (Leaver Pit) Toronto, Pt.
Lots 12, 13, 14, Con. 4 NS, Town of Burlington
19. Hayes, Road Supt. East Flamborough, Waterdown, Pt. Lot 3,
Con. 8, E. Flamborough Township
20. Indusmin Limited, Toronto 210
Acton Quarry SW & NE 1/2, Lots 23, 24, Con. 4, Esquesing Twp.
Halton Quarry E1/2 & W1/2, Lots 7, 8, Con. 6, Nassagaweya Twp.
21. Kemper, Jacob, R.R. 3, Campbellville, Pt. Lot 3, Con. 3,
E. Flamborough Township
22. Milton Brick Company Ltd.
Lots 1 & 2, Con. 7, Nassagaweya Township
Lots 1 & 2, Con. 1 Esquesing Township
23. Milton Quarries Ltd., Toronto 1, Pt. Lots 1 & 2, Con. 7,
Nassagaweya Township
24. Muldoon Holdings Ltd., Georgetown, Lot 26, Con. 8,
Esquesing Township
25. McPhail, W. Gordon, Campbellville, W1/2, Lot 6, Con. 3,
Nassagaweya Township
26. Natco Building Products Ltd., Toronto 12
Pt. Lots 9, 10, 11 & 12, Con. 1, E. Flamborough Twp.
27. National Sewer Pipe Ltd., Oakville, Pt. Lots 1, 2 & 3,
Con. 1 & 2, Town of Burlington
28. Nelson Crushed Stone, Div. King Paving & Materials Ltd.,
Lot 2, Con. 3 and W1/2, Lot 1, Con. 3, Town of Burlington
E1/2 Lots 1 & 2, Con. 2, Town of Burlington
29. Nelson Crushed Stone, Div. King Paving & Materials Ltd.,
Pt. Lot 8, Con. 1, Town of Burlington
30. Norton, Harvey, Limehouse, W1/2 Lot 26, Con. 9, Esquesing Twp.
31. Rice & McHarg Quarries Ltd., Pt. Lot 21, Con. 5, Esquesing Twp.
32. Salco Const. Ltd., Oakville, NE1/2 Lot 8, Con. 2,
Town of Burlington
33. Shaver, Dave Cartage, Hamilton, Lot 45, Con. 3, Ancaster Twp.
34. Sherman Sand & Gravel Ltd., Port Credit
Lots 5 & 6, Con. 5, Nassagaweya Twp.
Pt. Lot 11, Con. 5, Town of Burlington
Pt. Lot 12, Con. 5, Town of Burlington
Pt. Lot 12, Con. 4, Town of Burlington

35. Smith, William E., Jerseyville, Pt. Lot 36, Con. 3,
Ancaster Township
36. Tibbits Bulldozing Ltd., Hamilton, Pt. Lot 7, Con. 9 E.F.,
E. Flamborough Township

B) Extractive Operations Not licensed Under Bill 79: Wentworth
and Halton Counties.

1. Indusmin Ltd., Lot Ept. 22, Con. 4, Esquesing Twp.
2. Springbank Sand and Gravel, Lot 12, Con. 5 (New Survey)
Town of Burlington
3. John Trenwith, Lot 11, 12, Con. 4 (New Survey),
Town of Burlington
4. John and Amy Trenwith, Lot 8, Con. 2 (New Survey,
Town of Burlington
5. Diamond Clay Products, Lots 3, 4, Con. 1. (N.D.S.)
Town of Burlington
6. Marguerite Currie, Pt. E1/2 Lot 11, Con. 1. Nassagaweya Twp.
7. Dufferin Currie, Pt. E1/2 Lot 11, Con. 1, Nassagaweya Twp.
8. Walter Simmons, Pt. W1/2 Lot 8, Con. 4, Nassagaweya Twp.
9. Thomas Haulage Ltd., Lot 42, Con. 4, Ancaster Twp.
10. O. & J. Investments Ltd., Lot 45, Con. 3, Ancaster Twp.
11. Mrs. E. H. Phinn, Lot 41, Con. 4, Ancaster Twp.

APPENDIX II

BYLAWS REGARDING EXTRACTION WITHIN STUDY AREA

On the municipal level a number of bylaws regulating the industry have been passed. These will not be affected by the new "Act for the Regulation of Pits and Quarries".

Ancaster: has a by-law regulating pit operation.

Burlington: By-law #1638 (October 1958) demands -
grading of exhausted quarry, replacement
of overburden, tree planting.

By-law #1723 prohibits new pits and quarries.

East Flamborough: By-law #1352 (August 1958) and #1373
(July 1959) require re-grading of ex-
hausted quarry, and prohibit the en-
largement of existing quarries.

Nassagaweya: By-law #22-62 (August 1962) covers
a) interference with water courses and
b) storage and replacement of top soil
to the specifications of the Conserva-
tion Authority.

Oakville: By-law of 1963 prohibits quarrying in the
Escarpment area.

West Flamborough: By-law #2069 (February 1953) prohibits
new quarries.

Ancaster information is up-to-date; other by-law information
is drawn from "Quarrying and the Escarpment" pp. 31-33
(1966).

CHAPTER THIRTEEN

FORESTRY

leslie-ann thompson

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LAKE HURON FOREST DISTRICT - GENERAL

History shows, that until forest products become locally or nationally scarce, exploitation of forest resources is commonly tolerated. Realization of the need for good forestry practice seldom arises until the supply of renewable resources reaches a critical condition. This condition is now faced by the wood-using industries of Southern Ontario which are to a considerable extent dependent upon distant sources of supply.

The restoration of the local areas of depleted forest land to productivity, the building up of an adequate growing stock of timber, and the establishment of good forest management are thus matters of prime importance to this area. Secondary benefits in the control of stream flow and maintenance of water levels are increasingly important as population and industries continue to expand at a rapid rate. With the trend towards urban living, the recreation value of forested areas becomes additionally significant.¹

This district has two sections, Huron and Niagara. The Huron section is underlain by the Ordovician and Silurian rocks of the Palaeozoic Era. The limestone, sandstone, shale and dolomite are overlain by glacial material which may, in turn, be modified by wave action and lacustrine deposits. A broad-leaved forest is prevalent, and sugar maple and beech are the principal species. Elm (currently being eliminated by Dutch Elm disease) and soft maple are very common and many other deciduous species occur as scattered groups or individuals throughout the region.

The Niagara section occupies the most southerly latitude in

¹ Ontario Department of Lands & Forests, Division of Timber, Resources Inventory, 1958, p. 15.

Canada. The favourable climate and soil conditions permit the sole distribution in Canada of many deciduous forest species. Most of the associations are composed of broad-leaved trees, many of small size. Within this section occurs the main Canadian distribution of black walnut, sycamore, swamp white oak and shagbark hickory. In addition, it represents the northern limit for chestnut, tulip trees, mockernut and pignut hickories, chinquapin, chestnut, scarlet black and pin oaks, black gum, blue ash, magnolia, pawpaw, Kentucky coffee tree, redbud, red mulberry, and sassafras. Most of these species appear as scattered individuals, or groups, often on specialized sites. The more widely distributed butternut, bitternut hickory, rock elm, silver maple and blue beech are also present. Conifers are poorly represented except for plantations. The flat-lying Devonian limestones and shales are deeply covered by glacial material. The fertile soils accompanied by a favourable climate have resulted in heavy settlement accompanied by a great reduction in the original forest cover.²

FORESTRY IN HALTON COUNTY

The townships of Halton County were surveyed between 1806 and 1819. Surveyor's field notes record a primeval forest almost unbroken except for an occasional beaver meadow, a few Indian corn fields in the lower valley flats or a patch of windfall. The Surveyor Samuel Wilmot's notes show that the upland forests were mainly hard maple, beech and basswood with the pine and oak intermixed in smaller numbers. Just west of Milton Heights was an area in which pine predominated.

² Ontario Department of Lands & Forests, Division of Timber, Report #21 of the Lake Huron District, Forest Resources Inventory, 1958, p. 15.

Clearing of the land for agricultural settlement proceeded with little regard for land quality except swamp land. In 1846 Trafalgar Township had 23 sawmills. In 1850 Esquesing Township had 11 sawmills, while Nassagaweya had 7. Large volumes of pine boards, oak and pine timbers, barrel staves and ashes were exported. Oakville was a shipping port for the bulk of the production. From the 1840's on, increasing amounts of lumber were needed for local building and carriage manufacture. The peak of production for many products was reached in the period between 1870 and 1880. Maple sugar and syrup were important products; maximum production of 5,472 gallons is recorded for 1861.

Until about 1910 the decrease in woodland area was rapid. After that, the small remaining area of woodland was at least tolerated, and in some cases it has probably shown a slight increase. There is not, as yet, any evidence of a sharp increase in woodland cover such as might be brought about by a real enthusiasm for the reforestation of sub-marginal lands.⁶

Present Description

Halton County has a total land area of 235,196 acres and consists of four townships; Nassagaweya, Esquesing, Burlington, and Oakville. Approximately 97% of the land is privately owned. Public ownership is as follows:

Halton County Forest	1,387 acres ⁷
Halton Region Conservation Authority	1,839 acres
Province of Ontario	50 acres
Credit Valley Conservation Authority	<u>492 acres</u>
Total	3,768 acres

⁶ Ontario Department of Lands & Forests, Hespler, Management Plan for Halton County Forest Management Unit of the Lake Huron District for the period from April 1, 1963 to March 31, 1983, p. 13.

⁷ Same as above, p. 1.

The County Forest is comprised of 13 tracts; 11 are in Nassagaweya Township, and 2, the Acton and Coulson (or Hornby) tracts, are in Esquesing Township-the total acreage is 1,387 acres (see table 1 for forest inventory). The boundaries of all tracts are known and mainly follow the township survey lines. Although the status of these lands is as "privately owned lands", they may be put to multi-purpose use with approval of the owners.

Lands and Forests manages both the County Forest lands situated in Nassagaweya and Esquesing townships and the 50 acres of Crownland near Speyside in Esquesing Township. The most important physical feature modified by glacial advances and retreats is the Niagara Escarpment, entering Halton County in the south-west corner of Burlington Township and cutting diagonally across Esquesing Township, west of the towns of Milton and Georgetown. All properties except the Coulson tract are in Nassagaweya and Esquesing Township on the Limestone plain which extends into Flamborough and Beverly Township in Wentworth County. The limestone bedrock is at or near the surface over a large part of the area in these Townships. A few drumlins are scattered over this plain and swamps are numerous.

The overburden on the plain, apart from the drumlins, is bouldery glacial till or deposits of sand and gravel. Since most of the area is either wet or stony with shallow soils, much of the area is still wooded or in pasture. The swamps serve as water reservoirs and grow cedar or soft maple and elm, the latter now being eliminated by Dutch Elm disease. The deeper pockets of soil are capable of producing very good individual timber tree specimens while the general stand quality may be poor. Some hardwood swamps are capable of producing good-quality silver maple. The white pine appears to grow best on well-drained fresh to moist sandy-loam soils

with at least moderate depth. Attempts are being made to establish white pine on the clay-loam soils in the Coulson Tract. The small areas of red pine are performing well on the deep sandy soils. Spruce, European larch and white cedar are used mainly for aesthetic reasons to add variety to the scene or to occupy moist to wet sites.

The hardwood stands are of two main types - upland hardwoods, principally hard maple and associated species (basswood, ash, oak, etc.) (534 acres) and lowland or swamp hardwoods, principally silver maple and elm (245 acres). In addition, there are poplar and white birch stands occupying 184 acres, of which 55 acres of poplar are classed as Site-class 4 - Protection Forest.

Halton County Forest is managed under Section 2 of the Forestry Act which defines "forestry purposes" as follows:

"Forestry purposes" includes the production of wood and wood products, provision of proper environmental conditions for wildlife, protection against floods and erosion, recreation and protection and production of water supplies.

Multiple use of forest lands is applied to these lands for the following purposes:

1. Timber Production: The mature hardwoods will be primarily saw timber stands with some veneer quality trees. The mature pine stands should yield saw timber, poles and piling. Intermediate cuts (thinnings or stand improvement operations) will produce hardwood, boltwood, pine pulpwood, poles and posts and fuelwood.
2. Production and Protection of Wildlife and Wildlife Habitat: The wildlife resource will be encourage mainly by avoiding the unnecessary disturbance or destruction of wildlife habitat by fire or cutting operations.
3. Recreational Uses: * It has been customary to permit the public to make free use of Halton County Forest

* Agreement Forests to be incorporated into multiple-use parkland system as specified in the recommendations.

properties for simple recreational purposes such as walking, nature study and small, family picnics. The Halton County Forest properties and those purchased by the Halton Region Conservation Authorities (primarily for recreational purposes) constitute the bulk of the lands available to the general public for recreational use. As Halton forest properties are located close to large centres of population (Burlington, Hamilton, Guelph, etc.) it is apparent that recreational demands will increase. It is suggested that Halton County Forest and other Agreement Forests should serve as primitive forest parks as recreation demands increase.

4. Conservation of Soil and Water Resources: The protection of shallow soils will be achieved mainly by maintaining a continuous vegetative cover. It is most important to prevent fires which would damage or destroy the shallow soils.
5. The Demonstration of Forest Management Principles and Silvicultural Practices: This and other Agreement Forests should be managed to demonstrate basic forest management principles (e.g. forest division and the development of cutting sections) and effective silvicultural treatments. High standards in the conduct of cutting operations must be expected of logging contractors. The forest properties are available for observation and study to students and teachers at all levels, as well as to individuals interested in forestry and general conservation. Guided tours can be arranged through the District Office - Hespeler. The forest was not intended as a Research Forest. Applications to conduct research projects on Agreement Forests must be approved by the Chief of the Timber Branch.

FORESTRY IN WENTWORTH COUNTY

Little is known of the forest cover prior to the settlement of Wentworth County in the early 1800's, except in the notes of surveyors and a few early settlers. This is probably due to the abundance of wood and the lack of appreciation by people to whom the forest represented a barrier to agriculture.

Surveyors' notes indicate dense forest almost unbroken except for occasional 'meadow' along a stream, or patch of windfall.*

The attitude of the early settler was almost completely hostile. Transportation was poor and needs for construction material and fuel were negligible with respect to the total forest area, resulting in limited markets for wood products.

As new areas opened up, land was cleared first along the fronts of the farms. The woodland shrank farther and farther toward the end of the farm farthest from the road. This sequence was followed, in most cases, without reference to the quality of the soil except where it was swampy. This continued until 1910 after which land clearing declined. At present the forest cover of Wentworth County is 10.1% of the total area and of this 7.9% is productive forest.⁸

Present Description

Wentworth County has a total land area of 286,032 acres and consists of 9 townships; East and West Flamborough, Beverly, Binbrook, Glanford, Saltfleet, Ancaster, Stoney Creek and Dundas.

Wentworth County Forest consists of 7 tracts of land containing a total of 880 acres. Five of these tracts are located in Beverly Township, totaling 790 acres, and one each in East Flamborough and Binbrook Townships of 40 and 50 acres respectively.

⁸ Ontario Department of Lands and Forests, Hespeler, Management Plan for Wentworth County Forest Management Unit of the Lake Huron District for the period April 1, 1963 to March 31, 1983, p. 17.

* For additional information on forest cover, refer to Maycock, P.F., *The Phytosociology of the Deciduous Forests of Extreme Southern Ontario*, Canadian Journal of Botany, 41 (1963), 379-438.

The general topography of the Wentworth County Forest is flat to gently undulating. Beverly Township is predominantly a limestone plain on the western edge of a drumlin field whose shallow soils and drumlins laid down in Ordovician and Silurian epicontinental seas. The Newall Tract in East Flamborough is located in a spillway, while the Binbrook Tract is located on the Haldimand Clay Plain formed by deposits under the former Lake Warren.

Species Used

Up to 1957 Scotch Pine was a major species used in reforestation in Wentworth County Forest. Since 1962 the production of Christmas trees, mainly scotch pine, on agreement forests has ceased, removing this market. Scotch pine planting is confined to poorer marginal lands in Wentworth County. White pine is most extensively used in reforestation due to its predominance in original upland forest cover. Species associated with white pine are scotch pine, red pine and white spruce, as well as white ash, soft maple, jack pine and European larch. Lowland hardwoods include white elm and soft maple, as well as basswood and white ash. The white elm is gradually being eliminated by Dutch elm disease. Upland hardwoods include hard maple, white elm, hickory, white ash, basswood and red oak.

Economy

This part of the province is a rich agricultural area, but despite this, a total of 392 wood-using industries are presently operating in the Lake Huron District. These include 143 household furniture manufacturers, 86 sawmills, 58 sash and door planing mills and other miscellaneous wood-using industries.

TABLE 1

Land Classification in Wentworth County:¹¹

<u>Land Classification</u>	<u>Area in Acres</u>	<u>Area (percent)</u>
<u>Forested Land</u>		
Productive	23,268	8.1
Non-productive	6,210	2.2
Sub-total forested	29,478	10.3
<u>Agricultural Land</u>		
Developed	179,484	62.8
Grass and Meadow	25,660	9.0
Wooded Pasture	9,826	3.4
Sub-total Agricultural	214,970	75.2
<u>Other Areas</u>	41,584	14.5
Total Land Area	286,032	100.0
Water Area	2,614	

Total Area of Wentworth County = 288,646 Acres.

Land Classification in Halton County:¹²

<u>Land Classification</u>	<u>Area in Acres</u>	<u>Area (percent)</u>
<u>Forested Land</u>		
Productive	37,846	16.1
Non-productive	2,488	1.1
Sub-total Forested	40,334	17.2
<u>Agricultural Land</u>		
Developed	143,188	60.9
Grass and Meadow	18,204	7.7
Wooded Pasture	14,772	6.3
Sub-total Agricultural	176,164	74.9
<u>Other Areas</u>	18,698	7.9
Total Land Area	235,196	100.0
Water Area	1,394	
Total Area of Halton County	236,590 Acres	

¹¹ Ontario Department of Lands & Forests, Division of Timber, Report #21 of the Lake Huron District, Forest Resources Inventory, 1958, p. 1.

¹² Same as above, p. 10.

This large number of industries has become established and is dependent upon the wood produced on the many small private farm woodlots located in this geographical area. High value of the wood and accessibility have made the operation of these small 10-20 acre woodlots feasible.

ALLOWABLE CUTS ON PATENTED LAND

The annual allowable cut for patented land is 29,382,510 cubic feet. This represents 2.6% of the primary growing stock or 40.9 cubic feet per acre for the productive forest land. The annual allowable cut is 1.9% of the primary growing stock for conifers and 2.7% for hardwoods.

Coniferous species comprise 12% of the allowable cut. White cedar forms 58% of the coniferous allowable cut, equivalent to only 7.1% of the total allowable cut for patented lands.

76% of the hardwood allowable cut is obtained from 4 of the 17 hardwood species. Soft maple form 18% of the allowable cut, elm 15%, poplar 26%, and sugar maple 17%.

No statistics relating to the annual cut of timber on Crown lands in the Lake Huron district are collected by the Department of Lands and Forests. This district is essentially an area of privately owned lands for which data pertaining to timber production are not readily available. The volume and value of products produced from farm woodlots in 1950 is as follows:

Fuelwood.....	161,163	Cords
Pulpwood.....	315	Cords
Posts.....	119,112	Pieces
Logs.....	10,464,220	Board Feet
Poles.....	4,464	Pieces

The products listed were estimated to have a value of \$1,863,523, and to have produced, through sales, a cash income of \$725,398. In addition, maple syrup and maple sugar production within the district was valued at \$195,482 of which \$124,649 represented a cash income to the farmers. These figures do not include Christmas trees sold from private lands.¹

ACTS PERTAINING TO FORESTRY

The Forestry Act²

(2) The Minister may enter into agreement with the owners of lands that are suitable for forestry purposes for the management of such lands upon such terms and conditions as he deems proper, but no such agreement shall be entered into for a term of less than 20 years.

(3) The Minister may make grants out of the money appropriated therefore by the Legislature to any conservation authority or to any municipality for the purposes of assisting it in the acquisition of lands that are suitable for forestry purposes and that are to be managed under an agreement entered into under subsection 2 of such sums as are provided for in the agreement.

"Forestry purposes" included the production of wood and wood products, provision of proper environmental conditions for wildlife, protection against floods and erosion, recreation, and protection and production of water supplies.

¹ Ontario Department of Lands & Forests, Division of Timber, Report #21, Lake Huron District, Forest Resources Inventory, 1958, p. 27.

² The Forestry Act, 1960, Chapter 153 as amended by 1961-62, Chapter 47; 1967, Chapter 29.

Woodlands Improvement Act¹

Forestry purposes, as defined in the Forestry Act,² apply here. The Woodland Improvement Act refers to wooded properties not intended to produce immediate revenue, i.e. Christmas trees. "Woodlands" as referred to in this Act, are defined as follows:

- 400 trees/acre all sizes
- 300 trees/acre 2" diameter
- 200 trees/acre 5" diameter
- 100 trees/acre over 8" diameter

(all measurements taken 4½ feet from the ground)

(2) Subject to the regulation, the Minister may, upon such terms and conditions as he deems proper, enter into agreements with the owners of lands that are suitable for forestry purposes and that are situated in a private forest management area for the planting of nursery stock or the improvement of the woodlands on such lands. 1966, c. 161, s.2.

The Trees Act²

The interpretation of "forestry purposes" as defined in the Forestry Act applies. Boundary trees on adjoining land are common property of owners. There is a \$25.00 maximum fine for injury to trees without consent of owners.

Tree Conservation:

(4) Subject to the approval of the Minister of Lands and Forests, the council of any county, or any municipality separated from the county for municipal purposes, or any municipality in a territorial district, may pass by-laws,

- (a) restricting and regulating the destruction of trees by cutting, burning or other means; and
- (b) providing for the appointment of officers to enforce the provisions of any by-law passed under this section. R.S.O. 1960, c. 406, s. 4. (with specified exceptions)

¹ The Woodlands Improvement Act, 1966, Statutes of Ontario, 1966, Chapter 161.

² The Trees Act, Revised Statutes of Ontario, 1960, Chapter 406 as amended by 1964, Chapter 118; 1967, Chapter 103.

- maximum of \$500.00 fine or up to 3 months imprisonment for offences.
- by-law giving provisions for counties and cities, towns and villages less than 10,000 people, to acquire lands for forestry purposes.

10) (1) The council of any township may enter into agreements with the owners of lands located in the township providing for

- (a) the reforestation of portions of such lands;
- (b) the entry and planting of trees upon such portions by the servants or agents of the council; and
- (c) the fencing of such portions and conservation of all growing trees thereon by the owner.

(2) No such agreement shall provide for the reforestation of less than five acres of land for every 100 acres belonging to the same owner.

(3) Every such agreement shall prescribe the conditions under which the cutting of timber upon such portions may be carried out and such conditions are subject to the approval of the Minister of Lands and Forests.

LAND STATUSES UNDER LANDS AND FORESTS JURISDICTION

Different land statuses are included under the jurisdiction of Lands and Forests:

1. The Agreement Forests - County owned but managed by Lands and Forests
2. The Crown Land owned and managed by Lands and Forests
3. The Private Land Forestry Plans or WIA Agreements where a private land-owner enters into agreement with Lands and Forests
4. A programme recently started under Lands and Forests Extension Service - hunting permission on privately owned land. (The Ancaster Project).

WIA Agreements

Under WIA Agreements, the Lands and Forests plans some 2 million trees per year for timber products and land use improvement. Under such improvement schemes urban areas are demarcated as lower priority and a circle is drawn around the town to allow for urban sprawl. Conifers at a cost of approximately \$20/acre are planted in preference to hardwoods costing approximately \$100/acre. A certain small acreage of property under WIA Agreements is exempt from taxation. However, this exemption is not enticing enough to encourage woodlots. Income tax is still charged on any annual cut. (For further information, refer to the *Smith Report*, Lands and Forests, Toronto.)

Tree cutting by-laws are not enforced very well. However, they have acted as a deterrent and have presented wholesale destruction. There is still a negative approach. What is needed is a more positive management of woodlots through Forest Management Plan.

The WIA Private Land Forestry Programme for Halton and Wentworth operates under the extension service at Hespeler. The following services are provided:

1. Direct Assistance - WIA - advice for planting of open forest land or improvement of existing woodlots free of charge
 - owner pays a minimum amount for cost of trees and/or cost of improvement
2. Advisory Service
 - provides technical advice and plans in forest management
 - assistance in marking and marketing if woodlot is a commercial forest cut

3. Forestry Education and/or Public Relations

Ancaster Project

Another pilot extension programme originating from Lands and Forests at Hespeler is the Ancaster Project. This is the start of a series of agreements between land-owners and Lands and Forests allowing hunting on any or part of their lands. Such a service is common in Europe and has been operating in New York State for a number of years. This came about because of a desire on the part of a number of land-owners to close Ancaster Township completely to hunting.

The first step to start such a project in any county is the re-wording of a by-law giving written or implied permission so that the land-owner can decide whether or not he wants hunting on his property. The land-owner may close or open to hunting any combination of lands he desires. Restricted zones are strictly enforced by Lands and Forests at a fine of \$150.00. In addition, a Zenith telephone number is provided in case of emergencies or complaints. Initial agreements are one year in duration or longer if the owner so wishes and both parties can pull out any time with 60 days written notice. Wildlife shrubs are supplied by the Extension Service to increase wildlife species in the area at no cost to the owner. So far, the entire behaviour of the hunter in such agreement areas seems to have changed. This project has good possibilities and because of its multiple-use nature it should be expanded.

PLANNING BY THE DEPARTMENT OF LANDS AND FORESTS

The following plans and programmes have been undertaken by the Department of Lands and Forests on a province-wide basis:

- Forest Resource Inventory Programme
- Timber Management Plans
- Ecological Basis of Land-Use Planning
- Land Inventory Programme
- Fire Control Planning to protect the environment
- Master Planning for Provincial Parks
- Lake and Wildlife Inventory Programmes
- 1969 Planning, Programming and Budgeting System of management.

The 1969 *Planning, Programming and Budgeting System* of management (PPBS) has just been completed and is a major innovative step forward in land-use planning if the required planning mechanisms are created, to allow implementation of this programme. Such a programme requires a comprehensive description.

Planning is basically the selection of a course of action to achieve a desired result. The PPBS is proposed by the Government of Ontario to rationalize the resource allocation process. It offers a framework which establishes people-oriented objectives as the first step and follows through with an analysis of alternative courses of action to meet these objectives. Although emphasis is put on dollar analysis, a supplementary assessment of land and water inputs as well as Angus Hills' *Ecological Basis of Land-Use Planning* provides a philosophical approach.¹³

The application of Department policy and programmes is not uniform across the Province. Needs of the public vary from area to area depending on factors such as population densities, access to markets, availability of employment opportunities, access to recreation and so on. The character of

¹³ Ontario Department of Lands and Forests, Toronto, Mr. E.F. Anderson. A Planning, Budgeting and Control System for the Ontario Department of Lands and Forests, p. 5.

the natural resources is also variable. The species of fish, game and trees and the productivity of the land and water vary with changes in climatic, topographic and soil factors.

D.M. Patterson¹⁴ stresses that development policies must be reviewed, not only from the standpoint of their economic implications, but also from the standpoint of their social and political implications. He goes on to mention that

Some current examples are the need to preserve some urban breaks or greenbelts at a number of key spots in the Golden Horseshoe while there is yet time, the need to accompany high density apartment construction with more open space than we are getting, the question of how much weight to give to the views of farmers and speculators whose lands will come under future development and be occupied by thousands not yet here, and the question of how much weight to attach to a plebiscite signed by the present urban residents in an area which will have a much large future population.

He feels that there is widespread questioning and dissatisfaction with many of the old values of our society. Growth for the sake of growth is one value being questioned. Under these changes in societal values, forestry activities will be subjected to increasing control in response to recreation needs and aesthetic considerations.¹⁵

It seems reasonably safe to forecast that self-generated change or innovation is now a way of life and will continue. Forecasting the probably future technological developments in the natural resource production and outdoor recreation

¹⁴ Patterson, D.M., *Economic and Other Implications of Development policy* as prepared for the Ontario Economic Council's Study of Trends, Issues and Possibilities for Urban Development in Central and Southern Ontario.

¹⁵ Ontario Dept. of Lands and Forests, Toronto. Mr. E.F. Anderson, *A Planning, Budgeting and Control System* for the Ontario Dept. of Lands & Forests, p. 54.

fields is not only a challenge but a necessity. Responsible resource managers must be aware of these changes if they are to successfully meet the future needs of the people for resources and outdoor recreation opportunities.¹⁶

Conflicts develop frequently because of the economics of location. The land use conflict in the Niagara Fruit Belt has resulted from the fact that the lands have an extremely high capacity for both soft fruit production and residential, commercial and industrial development. From an urban standpoint, the accessibility to the Toronto-Hamilton-Buffalo corridor, the availability of adequate supplies of water for consumption and sewage treatment and the excellent access afforded by the Queen Elizabeth Way all combine to produce high capability urban land. From a soft fruit standpoint, the well drained sandy soils are excellent for orchard tree production and the temperate climate next to Lake Ontario protects the blooms from late spring frosts and the fruits from early fall frosts. It is exceedingly difficult to resolve this conflict since the cost of urban development elsewhere will be considerably higher and yet the soft fruit cannot be satisfactorily produced anywhere else in Southern Ontario.

In summary, the concept of quality environment has several dimensions for Lands and Forests. It is an end in itself in providing a suitable habitat for man and a means of producing living resources and providing quality recreation experiences.

¹⁶ Ontario Department of Lands and Forests, Toronto. p. 37.

RECOMMENDATIONS

A recent quote in *Design for Development*, 1970, states that

Forestry in the Niagara Region is at present of very limited economic significance. Well managed woodlots, however, would enhance the Region. They would a) provide recreational opportunities; b) control soil erosion, due to flooding, especially in Haldimand-Norfolk and other agricultural areas; c) windbreaks in sandy areas would reduce wind erosion; d) the Region is capable of producing high quality hardwoods such as walnut; e) enhance the Region's natural beauty and aesthetic value; f) afford environmental protection for fish, wildlife and waterbodies.¹⁷

This statement would tend to reinforce the Lands and Forests' attitudes that "forest activities will be subjected to increasing control in response to recreational needs and aesthetic considerations."¹⁸ It can be clearly evidenced that although the multiple-use nature of forestry becomes an important element when planning for open-space needs, it must be examined within a larger frame of reference.

Definition of Open Space

Forestry, agriculture, conservation lands and unique ecological areas, are interlocking parts of a mosaic which when integrated bring to mind the nebulous concept of "open space". As population pressures in this Southern Megalopolis region increase, the urgency to define the meaning and values of open space in physical and psychological terms becomes critical.

¹⁷ Regional Development Branch, Department of Treasury and Economics, June 2, 1970, *Design for Development: Niagara (South Ontario) Region. Phase I: Analysis*, p. 57.

¹⁸ Ontario Department of Lands and Forests, Toronto, M.E.F. Anderson, A Planning, Budgeting and Control System for the Ontario Department of Lands and Forests, p. 54.

1. In Southern Ontario, the term "wildlands" should be substituted for "wilderness" when referring to *undeveloped* open-space. These "wildlands" would include a) wildlife areas, b) natural features and landforms, and c) general open-space, privately owned or otherwise (i.e. conservation lands, forest agreement lands, privately owned woodlots, Crown lands, private organization lands) and would aim at preservation of the human, natural and historical environment.
2. Although the generalized view of open-space is one of undeveloped land, the term should be expanded in some contexts to include *developed* land. A prime example would be the preservation of high suitability agricultural areas, not only to produce crops but also to provide visual relief and an operational buffer to separate congested urban areas.
3. Due to increasing shortages of open-space of all contexts in Southern Ontario, multiple-usage of existing and future acquired open-spaces should be promoted. Usually open-spaces have potential for two or more of the following multiple-uses.
 - a) Forest, marsh and other "wildland" vegetation for soil and water conservation.
 - b) Educational value of natural environmental experience of seeing, hearing, smelling, and learning.
 - c) Ecological reserves to protect unique species and natural flora and fauna and to maintain a permanent gene pool to provide a constant supply of materials to other natural areas and other uses not yet known.¹⁹
 - d) Preservation of natural features and unique landforms.
 - e) Extensive open-space recreation.
 - f) Timber production.
 - g) Wildlife sanctuaries and production.

¹⁹ Ontario Department of Municipal Affairs, Haldimand-Norfolk Study (Chanasyk Report) - unpublished, p. 219.

h) Waterfowl production.

i) Fish production.

Ecological Reserve

The ecological reserve, a most strategic concept, would house and protect unique species and represent examples of naturally occurring communities. Such ecological reserves should be zoned in a three-tier arrangement:

1. an undisturbed inner core
2. an intermediate zone with minimum disturbance
3. an outer zone of low-density use

To avoid destruction in some cases it might be necessary to prevent exact location of such reserves from becoming public knowledge.

Land Classification of Open-Space

The potential and necessary multiple-usage of open-space suggests the following different land classifications:

1. intensively-used multiple-use recreational areas
2. multiple-use parkland
3. multiple-use natural areas (with the exception of ecological reserves)

Intensively-used recreational areas would be lands with high capability ratings to withstand the pressure of usage and the ecosystems contained would thus be human-conditioned.

Multiple-use parkland would be moderately used and should include Agreement Forests. This coincides with the Lands and Forests philosophy that Agreement Forests could be used as "primitive forest parks" as recreation demands increase. If proper planning is evidenced, small agreement woodlots

could form interconnecting linear cross-country links to the multiple-use parklands and the main high-density recreational nodes. To promote and encourage the maintenance and establishment of woodlots, greater emphasis could be placed on professional guidance, having the above purpose in mind; and monetary and better taxation incentives could encourage farmers to devote more attention to this resource.

Natural Areas, with the exception of ecological reserves, would be under multiple-use management as well, and would provide the populace with a chance to become a part of its environmental heritage. To protect this heritage, political implementation must be immediately forthcoming.

INTERVIEWS

1. Mr. E.F. Anderson, Lands and Forests, Whitney Block,
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5. Professor Chanasyk, Landscape Architecture, University
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28. Mr. Jewell, Tapleyville, Ontario.

PART FIVE
LOCAL AGENCIES SHAPING THE ENVIRONMENT

